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POLLUTION OF LAKE SUPERIOR AND ITS TRIBUTARY BASIN IN THE STATES OF MINNESOTA, WISCONSIN, AND MICHIGAN PROCEEDINGS OF CONFERENCE, SESSION (2nd) HELD AT DULUTH, MINNESOTA ON APRIL 29-30, 1970. VOLUME 2

Federal Water Quality Administration
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PROCEEDINGS

Minnesota
LAKE SUPERIOR
Wisconsin
Michigan

Second Session
April 29-30, 1970
Duluth, Minnesota
Vol. 2

CONFERENCE

In the Matter of Pollution of Lake Superior and its Tributary Basin – Minnesota – Wisconsin – Michigan

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U.S. DEPARTMENT OF THE INTERIOR ● FEDERAL WATER QUALITY ADMINISTRATION

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MR. FRANGOS: Well, I understand your question, and that is precisely, again, the purpose of these hearings, because at that time we will have a record upon which we can determine what the State's course of action ought to be and at the same time we can bring to you specifically the situation in each one of these communities and proceed along the lines that you suggested, again anticipating this October deadline that now stands.

MR. STEIN: I would say, from my point of view, that something as you have done in this Du Pont matter is the right procedure. I am not talking about the merits of this yet.

MR. FRANGOS: Right.

MR. STEIN: Now, I am just speaking for my part of the operation and I have another hat--standards compliance. I would think, in any case, that before we would consider a request for an extension and act on that from any particular State if there were an inter state situation involved, I can almost assure you that our agency would check this out with the other States involved, because I think any dealing with a date in an interstate situation evolves with the Federal Government and the other States and once this is done this will affect their programs too.

Maybe we are reaching for this procedure, but if this is all agreeable, it seems to me that this would be the equitable way of trying to do this. That is, if you feel that any date should be modified, if you notify us, and perhaps you can do this beforehand, check with the States, if you don't do that we will check with the other States involved, and then perhaps we can come up with a judgment on that.

MR. FRANGOS: Well, I think that sounds like the proper course. As you know, we are really just starting to get into this compliance area, and when you get involved with standards and the conference, this hasn't always been clear what the procedure should be, but I think the ones that you outlined are the ones that we intend to pursue.

MR. STEIN: Yes.

Mr. Purdy.

MR. PURDY: Mr. Chairman, I am concerned about tying ourselves up in procedures to the point of where we can't respond. I can visualize the problems within Michigan and then attempt to recognize what this means on the country as a whole in the way of compliance dates, and I am wondering if you are interested in the interim dates or the final compliance date? There are many interim dates that are adjusted 30 days, 45 days, 60 days.

MR. STEIN: No, no, no. Here, that is another point. I think you raised a good point.

One, and I noticed, paucity of interim dates in the Wisconsin presentation; maybe they are here. I think we can have a distinction between the interim dates and the final date, certainly. If an interim date is adjusted, of course, at least our Regional Office should be informed. If the Regional Office thinks that that adjustment of an interim date will be so firm or so important as to throw the chances of meeting the final date out, they will report to us and we will get in touch. If not, I think we don't make any move on the interim date.

The question here that comes up, though, is when we have a final date established by your State agency, sent in to the Secretary of the Interior, and the Secretary of the Interior accepts that as both a State date and a Federal date, then the shifting of that date presents some problems. I think this is going to be-- I think Mr. Frangos alluded to this--this is going to be hard work and undramatic. But I suspect if we are going to do pollution control, we are going to have to get some kind of procedure where we are going to have to coordinate any modifications of these final dates, both from the Federal people and the State people, since they are legal dates binding on both.

MR. PURDY: I am satisfied with this sort of approach.

MR. STEIN: All right.

MR. PURDY: We do have some, I think, 30, 40 compliance dates coming before our Commission every month.

MR. STEIN: Right.

MR. FRANGOS: Well, let me just respond to, I think, the request for the format on abatement schedules. And the reason these were not included, because it was our feeling that out of these hearings we will know exactly what kind of schedules we are talking about and we can present these to the conferees when we reconvene. In the meantime, we would anticipate working with the regional people of FWQA and see if we can't develop something that is at least acceptable to them. If not, at least they are fully advised of what the status is in each situation.

MR. STEIN: Well, again, I think we appreciate the attitude of the States in this, particularly the States at this table, and I think by working together we can work this out. Federal-State programs are never very easy to manage, but we just have to face it, I guess.

Are there any other comments or questions on the Wisconsin report?

MR. BADALICH: Mr. Chairman, the completion dates for the projects under the interstate water quality standards, wouldn't they be earlier than the date that we set for this conference, January of 1974?

MR. STEIN: Yes.

MR. BADALICH: It is my understanding all of the interstate water quality standards throughout the country were, you know, accepted by the Secretary last year or maybe even the year before this. So if you are talking about a 3- or 4-year period, it will be well within the January 1974 date.

MR. STEIN: Yes. But I think the conference recommendation, and I am looking for--

MR. BADALICH: That is Recommendation No. 5.

MR. STEIN: Yes, Recommendation 5, the phrase says, "This action is to be accomplished by January 1974 or earlier if required by Federal-State water quality standards."

Well, I think we set something up which is completely consistent, at least, from a technical and legal point of view. The dates that Mr. Frangos is concerned about are those earlier dates, earlier than January 1974,as required by Federal-State water quality standards, which are binding on this conference, and Wisconsin is holding these meetings to consider the equities in perhaps extending some of these dates.

MR. FRANGOS: Yes.

MR. STEIN: And this is the problem.

MR. FRANGOS: Well, let me make this perfectly clear--that we do not look to the outside date set by this conference as any reason for easing up on any of these restrictions. We view this apart from whatever legal commitments and responsibilities that we have strictly from our own State point of view that these are very serious and that we are exercising every legal and administrative device that we have to get cleanup.

MR. STEIN: Right. Well, if I don't get a voluntary response, I am going to move around and try to poll the people. You don't have to answer this if you have no feeling.

Have you come to any conclusion yet on the proposal for Du Pont?

MR. FRANGOS: Yes, we would recommend that very strongly.

MR. STEIN: Do you want to comment on that, Mr. Purdy?

MR. PURDY: I did. I agreed with it.

MR. STEIN: Yes. How about you?

MR. MAYO: I think there are three principal points going for the recommendation. First, it assures a 60-percent reduction in the wastes now. Second, there are specific interim dates provided for. And third, it will end up with the complete elimination of the discharge and you can't ask for anything better than that.

I would suggest that we concur in the recommendation.

MR. STEIN: How about Minnesota?

MR. BADALICH: Well, Mr. Chairman, as long as the system is going to be a closed system and recycling the waters, we see no problem. I think Du Pont should be complimented on their program.

MR. STEIN: Right. The sole point is that the project will be in effect on May 1, 1972, which is a little later than it was originally anticipated. But there will be an interim cleanup.

I guess the views are unanimous that this is a reasonable program on the part of Du Pont. And, again, I think I would join with Mr. Badalich on this, because, when we had the first session of the conference, you recognize that we had a real vexing problem with this red water coming out of the TNT plants. There were many remarks made that the technology was not available to handle this waste. Now, if the industry has come up with a system that is in effect a closed system and completely eliminates this waste, I think this is a wonderful thing and a real breakthrough, and I hope this will work out.

So I think the conference can stand on record on that and we will take these views back to the Secretary of the Interior.

Are there any other comments or questions?

MR. FRANGOS: Just a point of clarification, Murray. The point is we need to proceed, and are you suggesting that we can go ahead and tell these people yes? Or do we need some action out of the Secretary's office?

MR. STEIN: I don't want to act ultra vires.

MR. FRANGOS: Right.

MR. STEIN: I am going to recommend that the Secretary approve this, certainly with the backing and the views of the conferees on this, that we go ahead. Now, the problem, as you know, Tom--and let this get off the record.

(Off the record.)

MR. STEIN: Back on the record.

MR. MAYO: I have one more question, Mr.

Frangos.

Does the Wisconsin boat toilet law apply to federally-documented pleasure boats?

MR. FRANGOS: I believe it would apply. The only specific limitation in the law is whether it is in interstate commerce, and perhaps you can answer that better than I can. It would hinge on that definition and I am not certain whether it does or not.

MR. STEIN: Are there any other comments or questions?

If not, thank you very much, Mr. Frangos, for an excellent report. As always, the Wisconsin report is very informative.

May we call on Michigan.

MR. PURDY: Mr. Chairman, I would like to have Mr. Courchaine give Michigan's report.

ROBERT J. COURCHAINE, REGIONAL ENGINEER
MICHIGAN WATER RESOURCES COMMISSION
LANSING, MICHIGAN

MR. COURCHAINE: Mr. Chairman, conferees, ladies and gentlemen.

R. J. Courchaine

At the first session which began in Duluth, Minnesota, on May 13, 1969, a joint report was submitted on behalf of the Michigan Water Resources Commission and the Michigan Department of Public Health which outlined various State programs to abate pollution and enhance the quality of the waters of Lake Superior and its tributaries.

This current report describes current programs undertaken by Michigan to implement the State-oriented recommendations of the Secretary of the Department of the Interior stemming from the first session. Information in this report related to these recommendations has been reviewed, updated and amplified.

Recommendation No. 1 was that a Technical Committee be formed. Two staff members of the Michigan Water Resources Commission have represented Michigan at all meetings of this Technical Committee.

Recommendations 2 and 3 referred to the Reserve Mining Company.

Recommendation No. 4 requires the States substantially strengthen water quality surveillance plans for the Lake Superior Basin and report to the conferees at the next session of the conference.

R. J. Courchaine

Michigan's water quality surveillance programs for the Lake Superior Basin were described in detail in Chapter V of the "Report on Water Pollution Control in the Michigan Portion of the Lake Superior Basin and Its Tributaries." This report was submitted at the conference called by the Secretary of the Interior in May 1969. An updating of the information presented in the first report is included in Appendices A, B, C, D and E of this report. Data from the tributary monitoring program and bacteriological monitoring program have been placed in STORET.

During the summer of 1969 algae samples were collected from four locations in Lake Superior to provide qualitative and quantitative algal data.

Recommendation 5. Secondary biological waste treatment be provided by all municipalities discharging directly to or affecting Lake Superior by January 1974.

On April 7, 1970, letters were sent to municipalities now having primary treatment and affecting Lake Superior water quality or its bays or harbors, explaining that they would be required to provide secondary biological waste treatment or its equivalent by not later than January 1974 and 80 percent reduction of total phosphorus by January 1975. The letter requested each municipality to transmit formal verification of their intent to voluntarily comply with these pollution control requirements. A stipulation, including performance schedules, will be developed when such verification is received. If verification is not received, the Water Resources Commission will initiate procedures leading to the issuance of a final order of determination to insure that the requirements of the conference are met timely. A copy of the letter sent to municipalities is included in Appendix G of this report.

Recommendation 6 requires continuous disinfection throughout the year for all municipal waste effluents.

In January 1967 a policy was adopted by the Michigan Department of Public Health requiring year-round disinfection of waste effluent from all municipal treatment plants prior to discharge to the surface waters of the State. With the exception of the city of Bessemer this program is in full force and effect at all such communities within the Lake Superior Basin. The city of Bessemer is under order of the Water Resources Commission to provide chlorination, phosphorus removal and improved secondary treatment by not later than December 1971. Growing numbers of Michigan communities are instituting bacteriological testing programs as a check on chlorine residuals and regimens. Appendix H lists the 1969 bacteriological quality of municipal waste discharges to the Michigan portion of the Lake Superior Basin.

Recommendation 7 requires disinfection of industrial effluents containing pathogenic organisms or organisms which indicate the presence of such pathogens.

Where a public health hazard can be anticipated or shown to exist from an industrial waste effluent, disinfection of the waste is required prior to discharge.

Recommendation 8. Waste treatment be provided by municipalities to achieve at least 80 percent reduction of total phosphorus to be accomplished by January 1975, not later than January 1975.

On April 7 letters were sent to municipalities explaining that they would be required to install and operate facilities for achieving a minimum of 80 percent removal of total phosphorus from their wastes by not later than January 1975. The letter to municipalities now having primary treatment also suggests that their engineers evaluate the need for providing additional treatment in light of the State's intrastate water quality standards. We have requested each municipality to transmit formal verification of their intent to voluntarily comply. The stipulation including performance schedules will be developed when such verification is received. If such verification is not received, the Commission will initiate statutory enforcement procedures leading to the issuance of a final order of determination to assure that the requirements of the conference are met timely. Copies of the letters sent to the municipalities are included in Appendix I.

Recommendation 9, discharges of compatible industrial wastes to municipal sewer systems be encouraged. Industries not connected to municipal sewer systems provide treatment equivalent to that of municipalities, this action to be accomplished by not later than January 1974.

Michigan has had a long-standing program that encourages the discharge of industrial wastes to municipal collection and treatment systems where such wastes are compatible or can be made compatible by pretreatment.

Appendix J includes a description of the type of waste treatment provided by industries, the status of their treatment and abatement action being taken to implement this recommendation. This abatement action is listed in an addendum which has been added to the report dated April 1970. There are currently three industries listed which have a total of five discharges directly to Lake Superior. All three industries have satisfactory abatement programs which adequately control the quality of their discharges.

The Hoerner-Waldorf Pulp and Paper Mill at Ontonagon discharges wastes into the Ontonagon River near the mouth, affecting water quality in Lake Superior. The company has been notified of the need to provide secondary treatment of its wastes by January 1974.

A recent amendment to Act 245, Public Acts of 1929, requires that every industrial or commercial entity which discharges liquid wastes into any public lake or stream shall have waste treatment facilities under the control of operators certified by the Commission. The rules of certification are contained in Appendix K.

R. J. Courchaine

Recommendation 10 calls for a listing of waste sources which have a deleterious effect on Lake Superior water quality. This has been added, as I mentioned, by an addendum to the Michigan report dated April 1970. This addendum lists some 16 communities, 4 of which are already under order of the Water Resources Commission to provide improved treatment, including phosphorus removal.

Where abatement actions are pending on the other communities, the Water Resources Commission will either enter into a stipulation or will enter an order requiring accomplishment of treatment in accordance with a time schedule which will require:

A date for retaining engineers;

A date for submitting preliminary engineering reports;

A date to initiate detailed engineering plans and specifications;

A date to submit detailed engineering plans and specifications;

A date to arrange financing;

A date to initiate construction;

And a final completion and compliance date.

Appendix J lists the industrial waste effluent dischargers within the Lake Superior Basin while Appendix L lists the municipal waste effluent dischargers. The tables in these Appendices summarize information on the type of discharge, type of treatment provided, improvement needs and the program for remedial action where such is needed.

Recommendations 11 and 12, unified collection systems serving contiguous urban areas be encouraged and pollution control agencies accelerate programs to provide for the maximum use of areawide sewerage facilities.

Act 228, Public Acts of 1967, is an act to regulate the subdivision of land and to promote the public health by providing authority to the Michigan Department of Public Health to approve subdivision developments not served by public sewers, contingent on the suitability of soils. This new program has already had a beneficial effect in accelerating municipal collection and disposal systems in nearby developing areas and preventing use of septic tank-tile field systems in unsuitable areas.

Act 329, Public Acts of 1966, as amended, establishes authority to provide State grants for sewage treatment facilities in conjunction with Federal grants under United States Public Law 84-660, as amended. Pertinent provisions of Act 329 dealing with unified waste collection and treatment programs are shown in the report.

Recommendation 13. Each State water pollution control agency lists the municipalities or communities having combined sewers, a proposed plan for minimizing bypassing, and Recommendation 14, existing combined sewers be separated is coordination with all urban reconstruction projects.

Appendix M of the report includes a list of municipalities having combined sewers.

In its supervisory capacity over municipal waste collection and treatment systems, the Michigan Department of Public Health continues to promote the most effective utilization of these systems. Adjustable regulating devices at points of combined overflow are one of a number of techniques utilized to make use of system storage capacities and minimize combined overflows.

In Michigan's water quality standards program and plan of implementation, the Commission has developed a policy wherein all new sewerage systems are to be developed on the basis of separate sewers for stormwater and sanitary wastewaters. Whenever feasible, separated sanitary wastewater systems are not to be discharged into existing combined systems. If such a discharge does occur, control facilities must be developed on the combined system to provide for enhancement of the receiving water quality commensurate with present and proposed future water uses and must be consistent with the requirements of State law. In those areas where noncompliance with the standards is determined to exist as the result of overflows of sanitary wastewater in storm runoff, the Commission is requiring the best practicable treatment or control no later than June 1, 1977.

Recommendation 15. The States institute necessary controls with respect to chlorinated hydrocarbon insecticides.

Act 233, Public Acts of 1959, as last amended by Act 91, Public Acts of 1968, provides for the licensing of persons engaged in the business of applying pesticides and economic poisons out of doors, with the licensing program being administered by the Director of the Michigan Department of Agriculture. The act further establishes an Advisory Committee to consult with and aid the Director in the administration of the act. The committee is composed of representatives of the Department of Public Health, Department of Natural Resources, the Aeronautics Commission, the Water Resources Commission, and the Pesticide Research Center of Michigan State University.

Based upon agricultural research at Michigan State University, the Michigan Department of Agriculture was advised that almost all uses of DDT in Michigan could be replaced by using other generally less persistent pesticides. A regulatory action cancelling registrations for the general sale of DDT followed, effective June 27, 1969.

A copy of Act 91, Public Acts of 1968, is attached as Appendix N.

Recommendation 16.

Uniform State requirements for controlling wastes from watercraft be adopted.

As previously reported, the Michigan Water Resources Commission in January 1968 adopted rules and regulations to control pollution from marine toilets on watercraft. The rules do not allow the macerator-chlorinator and do authorize the use of holding tanks or incinerators. The rules became effective January 1, 1970, and public acceptance of this program has generally been encouraging. Private marina operators are beginning to install pump-out stations and treatment facilities where these are needed, and the Michigan Waterways Commission has accelerated its program to provide similar facilities at State harbors of refuge on the Great Lakes. Two State-assisted marinas (one at Marquette and one at Ontonagon) are planning to install pump-out stations on Lake Superior.

Recommendation 17. The dumping of polluted dredged material into Lake Superior be prohibited.

Act 247, Public Acts of 1955, as amended, authorized the former Department of Conservation to regulate the deposition of materials on State bottom lands. All requests for deposition of materials on such lands are evaluated to determine, prior to the issuance of a permit, whether the material to be deposited contains substances which will cause pollution.

R. J. Courchaine

Recommendation 18. Programs be developed by appropriate State and Federal agencies to control soil erosion in the basin.

Under the authority vested in the Department of Natural Resources to protect and conserve the natural resources of the State, permits to allow the construction of culverts, bridges, road improvement projects involving public waters and structures affecting navigation must be issued under Act 211, Public Acts of 1965 by the Hydrological Survey Division of the Bureau of Water Management. This same Division issues permits when underground utility projects are to cross or be within 50 feet of a stream, lake or reservoir. The objective is to insure good construction practices so that watercourses are protected from siltation and unreasonable obstruction to flow. Portions of the "Handbook of Specifications for the Protection of Natural Resources" which outlines procedures to prevent siltation are presented in Appendix O.

Under provisions of Act 296, Public Acts of 1936, Michigan has been divided into 82 soil conservation districts. In the Lake Superior Basin these districts have developed programs with highway construction firms and utilities to help reduce erosion during construction. Similar programs are being developed to deal with subdividers and shopping center developers. The districts urge landowners to have provisions written into easements that require pipeline companies to restore topsoils after the completion of construction.

Recommendation 19. The discharge of visible oil from any source be eliminated.

Discharges which cause visible films of oil, gasoline or related materials on public waters are not permitted under any of the water uses listed in the Interstate Water Quality Standards adopted by the Michigan Water Resources Commission on June 28, 1967.

There are no known potential sources of major spills of oil or other hazardous materials in the Michigan portion of the Lake Superior Basin.

Now, changes in other programs.

Michigan's Clean Water Bond Program.

The bond program that was described in Chapter 1 of Michigan's report to the first session has gotten under way. In June 1969 the Michigan State Legislature passed implementing legislation to provide for spending $285 million of the bond proceeds for sewage treatment works and intercepting sewers. In July 1969 implementing legislation was passed to authorize the use of the remaining $50 million for grants to assist in financing construction of collecting sewer systems.

A priority list of projects has been developed and has been approved by the Commission and the Michigan Legislature. At each monthly meeting of the Commission a report is presented which lists changes in the status of grant offers and developments since the previous meeting and summarizes all action to date. The report submitted at the April 1970 meeting is included in Appendix P.

Water use designation for upper peninsula waters previously exempted.

After issuance of the Attorney General's opinion, Number 4590 described in Chapter 1 on Michigan's report to the first session, the Michigan Water Resources Commission held a public hearing on August 20, 1969, on the proposed water use designations for those waters previously exempted. The recommendations resulting from the hearing and previous staff recommendations were adopted by the Commission on November 19, 1969, and are presented in Appendix Q.

That ends my report, Mr. Chairman.

(Which said report follows:)

FOR THE RECONVENED CONFERENCE
SECOND SESSION
ON
POLLUTION OF THE INTERSTATE WATERS
OF
LAKE SUPERIOR AND ITS TRIBUTARY BASIN
(MINNESOTA - WISCONSIN - MICHIGAN)

CALLED BY
MURRAY STEIN, CONFERENCE CHAIRMAN
DEPARTMENT OF THE INTERIOR

STARTING APRIL 29, 1970
DULUTH, MINNESOTA

ON BEHALF OF
THE
MICHIGAN WATER RESOURCES COMMISSION
DEPARTMENT OF NATURAL RESOURCES
AND
MICHIGAN DEPARTMENT OF PUBLIC HEALTH

APRIL 1970

MICHIGAN WATER RESOURCES COMMISSION

John E. Vogt, Chairman, representing the Director, Michigan Department of Public Health

Stanley Quackenbush, Vice Chairman, representing the Director, Department of Agriculture

Gerald E. Eddy, representing the Director, Department of Natural Resources

John P. Woodford, representing the State Highway Commission

George F. Liddle, representing Municipal Groups

John H. Kitchel, representing Organized Conservation Groups

Jim Gilmore, representing Industrial Management Groups

Ralph W. Purdy
Executive Secretary

Purpose

At the first session which began in Duluth, Minnesota on May 13, 1969, a joint report was submitted on behalf of the Michigan Water Resources Commission and the Michigan Department of Public Health which outlined various state programs to abate pollution and enhance the quality of the waters of Lake Superior and its tributaries.

This current report to be presented at the second session, will describe programs undertaken by Michigan to implement the state-oriented recommendations of the Secretary of the Department of the Interior stemming from the first session. Information in this report related to these recommendations has been reviewed, up-dated and amplified.

RECOMMENDATION 1

> A Technical Committee to evaluate water quality criteria for Lake Superior be formed of the conferees and such representatives as they may designate, within two weeks of the Executive Session. The purpose of the Committee is to develop particular water quality criteria as guidelines for modification of the Federal-State Water Quality Standards. The provision of the necessary secretarial assistance to the Committee will be the responsibility of the Federal conferee. The Committee may coordinate its activities with other committees or agencies, or engage consultants, as it determines appropriate. At the next session of the conference, the Committee will report to the conferees on recommendations agreed upon for changing or modifying existing water quality criteria to reflect desired quality conditions in Lake Superior.

The Technical Committee has been formed and has met on three separate occasions. Two staff members of the Michigan Water Resources Commission have represented Michigan at all meetings of the Technical Committee. The chairman of the committee, Dale Bryson of the Federal Water Pollution Control Administration, will present a report on the recommendations of the committee at the reconvened conference, second session.

RECOMMENDATION 4

> The FWPCA and the States substantially strengthen water quality surveillance plans for the Lake Superior Basin to insure that plans are sufficiently sensitive to monitor changes in water quality. The FWPCA and the States are requested to report to the conferees at the next session of the conference concerning their program.

Michigan's water quality surveillance programs for the Lake Superior Basin were described in detail in Chapter V of the "Report on Water Pollution Control in the Michigan Portion of the Lake Superior Basin and Its Tributaries". This report was submitted at the conference called by the Secretary of the Interior on pollution of Lake Superior and its tributary basin in May 1969. An updating of the information presented in this chapter and in Appendices L, M, N, O and P of the first report is included in Appendices A, B, C, D and E of this report. Data from the tributary monitoring program and bacteriological monitoring program have been placed in

STORET. During the summer of 1969 two or three algae samples were collected from four locations in Lake Superior to provide qualitative and quantitative algal data. This data is stored in STORET and is shown in Appendix F.

RECOMMENDATION 5

> Secondary biological waste treatment or its equivalent be provided by all municipalities discharging directly to or affecting Lake Superior or its bays or harbors or interstate tributary streams. This action is to be accomplished by January 1974 or earlier if required by Federal-State Water Quality Standards.

On April 7, 1970 letters were sent to municipalities now having primary treatment and affecting Lake Superior or its bays or harbors explaining that they would be required to provide secondary biological waste treatment or its equivalent by not later than January 1974 and 80% reduction of total phosphorus by January 1975. The letter requested each municipality to transmit formal verification of their intent to voluntarily comply with these pollution control requirements. A Stipulation, including performance schedules, will be developed when these letters are received. If verification is not received, the Commission will initiate procedures leading to the issuance of a Final Order of Determination to insure that the requirements of the conference are met timely. A copy of the letter sent to the municipalities is included in Appendix G.

RECOMMENDATION 6

> Continuous disinfection be provided throughout the year for all municipal waste treatment plant effluents which are discharged to or affect Lake Superior or its bays or harbors or interstate tributaries. This action is to be accomplished as soon as possible and not later than May 1970.

In January 1967, a policy was adopted by the Michigan Department of Public Health requiring year-round disinfection of waste effluent from all municipal treatment plants prior to discharge to the surface waters of the state. This program is in full force and effect at all such communities within the Lake

Superior basin. In addition, growing numbers of communities are instituting bacteriological testing programs as a check on chlorine residuals and regimens. Appendix H lists the 1969 bacteriological quality of municipal waste dischargers to the Michigan portion of the Lake Superior Basin.

RECOMMENDATION 7

> Continuous disinfection be provided for industrial effluents containing pathogenic organisms or organisms which indicate the presence of such pathogens which are discharged directly to or affect Lake Superior or its bays or harbors or interstate tributaries. This action should be accomplished as soon as possible and not later than May 1970.

Where a public health hazard can be anticipated or shown to exist from an industrial waste effluent, disinfection of the waste is required prior to discharge.

RECOMMENDATION 8

> Waste treatment be provided by municipalities to achieve at least 80 percent reduction of total phosphorus from each State. This action is to be accomplished by January 1975 or earlier if required by Federal-State Water Quality Standards. At the next session of the conference, the conferees will present a detailed time schedule for their proposed programs.

On April 7, 1970 letters were sent to municipalities explaining that they would be required to install and operate facilities for achieving a minimum of 80% removal of total phosphorus from their wastes by not later than January 1975. The letter to municipalities now having primary treatment also suggests that their engineers evaluate the need for providing additional treatment in light of the State's Intrastate Water Quality Standards. The letters requested each municipality to transmit formal verification of their intent to voluntarily comply with these pollution control requirements. A Stipulation, including performance schedules, will be developed when these letters are received. If such verification is not received, the Commission will initiate procedures leading to the issuance of a Final Order of Determination to assure that the requirements of the conference are met timely. Copies of the letters sent to municipalities are included in Appendix I.

RECOMMENDATION 9

> Discharges of compatible industrial wastes to municipal sewer systems be encouraged. Industries not connected to municipal sewer systems provide treatment equivalent to that of municipalities so as not to cause degradation of Lake Superior water quality. This action is to be accomplished by January 1974 or earlier if required by Federal-State Water Quality Standards.

Michigan has had a long standing program that encourages the discharge of industrial wastes to municipal collection and treatment systems where such wastes are compatible or can be made compatible by pretreatment.

Appendix J includes a description of the type of waste treatment provided by industries, the status of their treatment and any abatement action being taken against these industries. There are currently three industries listed which have a total of five discharges directly to Lake Superior. All three have satisfactory abatement programs which adequately control the quality of their discharges.

A recent amendment to Act 245, Public Acts of 1929, requires that every industrial or commercial entity which discharges liquid wastes into any public lake or stream shall have waste treatment facilities under the control of operators certified by the Commission. The rules of certification are contained in Appendix K.

RECOMMENDATION 10

> Each State water pollution control agency make necessary corrections to the list in Appendix A (U. S. Department of the Interior report "An Appraisal of Water Pollution in the Lake Superior Basin", April 1969) of municipal and industrial waste discharges to the Lake Superior Basin. In addition, information should be provided on each source to indicate whether it discharges pollutants, including nutrients, that have a deleterious effect on Lake Superior water quality. Detailed action plans for treatment of all wastes having deleterious effects should be developed where not already completed. Such plans shall identify the principal characteristics of the waste material now being discharged, the proposed program for construction or modification of remedial facilities, and a time-

> table for accomplishment, giving target dates in detail. This list shall be presented to the conferees at the next session of the conference.

Appendix J lists the industrial waste effluent dischargers within the Lake Superior basin while Appendix L lists the municipal waste effluent dischargers. The tables in these appendices summarize information on the type of discharge, type of treatment provided, improvement needs and the program for remedial action where such is needed. These tables are revised editions of those originally submitted in Appendices I and J of "Report on Water Pollution Control in the Michigan Portion of the Lake Superior Basin and its Tributaries".

RECOMMENDATION 11

> Unified collection systems serving contiguous urban areas be encouraged.

RECOMMENDATION 12

> Each of the State's water pollution control agencies accelerate programs to provide for the maximum use of area-wide sewage facilities to discourage the proliferation of small treatment plants in contiguous urbanized areas and foster the replacement of septic tanks with adequate collection and treatment.

Act 228, Public Acts of 1967, is an act to regulate the subdivision of land, and to promote the public health by providing authority to the Michigan Department of Public Health to approve subdivision developments not served by public sewers, contingent on the suitability of soils. This new program has already had a beneficial effect in accelerating municipal collection and disposal systems in nearby developing areas and preventing use of septic tank-tile field systems in unsuitable areas.

Act 329, Public Acts of 1966, as amended, establishes authority to provide state grants for sewage treatment facilities in conjunction with federal grants under United States Public Law 84-660, as amended. Pertinent provisions of Act 329 dealing with unified waste collection and treatment programs are as follows:

"Sec. 7. Effective July 1, 1968 a grant shall not be made until the local agency's governing body has adopted and submitted to the water resources commission a comprehensive long-range plan for the control of pollution in the area within its jurisdiction, hereinafter referred to as the official plan. If more than 1 local agency has authority to provide service for sewage collection in the same area, the required plan may be submitted jointly by the local agencies concerned or by 1 local agency with the concurrence of the others.

"Sec. 8. An official plan shall:

(a) Provide for timely construction of sewage treatment facilities which will prevent the discharge of untreated or inadequately treated sewage or other wastes as defined by Act No. 245 of the Public Acts of 1929, as amended, being sections 323.1 to 323.12a of the Compiled Laws of 1948, into the waters of the state.

(b) Provide for adequate planning, zoning, population projections and engineering and economic studies to delineate with all practicable precision those portions of the area which public sewerage systems may reasonably be expected to serve within 10 years, and within 20 years, and any areas in which the provision of such services is not reasonably foreseeable.

(c) Be in compliance with the state pollution control plan required by United States Public Law 84-660, as amended.

(d) Set forth a time schedule and proposed method of financing, construction and operation of the pollution control system.

(e) Be reviewed by the official planning agencies having jurisdiction within the local agency, including the regional planning agency, if any, for consistency with programs of planning for the area, which reviews shall be transmitted to the water resources commission with the plan.

"Sec. 10. (1) The water resources commission may approve the official plan as submitted or, if it finds the plan to be inconsistent with proper local or regional water pollution control, it may return the plan for appropriate modification. Where more than one local agency is involved in an official plan and the local agencies are unable to agree upon an official plan which the commission will approve, the commission shall develop the necessary official plan.

(2) The commission may provide technical assistance to local agencies in coordinating official plans.

(3) The commission shall cooperate with all appropriate federal, state, interstate and local agencies and with appropriate private organizations."

RECOMMENDATION 13

Each State water pollution control agency list the municipalities or communities having combined sewers. The listing should include a proposed plan for minimizing bypassing so as to utilize to the fullest extent possible the capacity of interceptor sewers for conveying combined flow to treatment facilities. The States are requested to report on the listing of municipalities at the next conference session. Construction of separate sewers or other remedial action to prevent pollution from this source is to be completed by December 31, 1979, or earlier if required by Federal-State Water Quality Standards.

RECOMMENDATION 14

Existing combined sewers be separated in coordination with all urban reconstruction projects except where other techniques can be applied to control pollution from combined sewer overflows. Combined sewers should be prohibited in all new developments.

Appendix M includes a list of municipalities having combined sewers.

In its supervisory capacity over municipal waste collection and treatment systems, the Michigan Department of Public Health continues to promote the most effective utilization of these systems. Adjustable regulating devices at points of combined overflow are one of a number of techniques utilized to make use of system storage capacities and minimize combined overflows.

In Michigan's water quality standards program and plan of implementation, the Commission has developed a policy wherein all new sewerage systems are to be developed on the basis of separate sewers for storm water and sanitary waste waters. Whenever feasible, separated sanitary wastewater systems are not to be discharged into existing combined systems. If such a discharge does occur, control facilities must be developed on the combined system to provide for enhancement of the receiving water quality commensurate with present and proposed future water uses and to be consistent with the requirements of state law. In those areas where noncompliance with the standards is determined to exist as the result of overflows of sanitary waste water in storm runoff, the Commission is requiring the best practicable treatment or control no later than June 1, 1977.

RECOMMENDATION 15

> The States institute necessary controls to ensure that the concentration of DDT in fish not exceed 1.0 micrograms per gram; DDD not exceed 0.5 micrograms per gram; Dieldrin not exceed 0.1 micrograms per gram and all other chlorinated hydrocarbon insecticides, singly or combined, should not exceed 0.1 micrograms per gram, * (limits apply to both muscle and whole body and are expressed on the basis of wet weight of tissue). Other such environmental standards for insecticides in the Lake Superior Basin be established upon agreement by the States and the FWPCA after establishing an intensive monitoring program.

Act 233, Public Acts of 1959, as last amended by Act 91, Public Acts of 1968, provides for the licensing of persons engaged in the business of applying pesticides and economic poisons out of doors, with the licensing program being administered by the Director of the Michigan Department of Agriculture. The act further establishes an Advisory Committee to consult with and aid the Director in the administration of the act. The committee is composed of representatives of the Department of Public Health, Department of Natural Resources, the Aeronautics Commission, the Water Resources Commission, and the Pesticide Research Center of Michigan State University.

Based upon agricultural research at Michigan State University the Michigan Department of Agriculture was advised that almost all uses of DDT in Michigan could be replaced by using other, generally less persistent materials. A regulatory action cancelling registrations for the general sale of DDT followed, effective June 27, 1969.

A copy of Act 91, Public Acts of 1968 is attached as Appendix N.

RECOMMENDATION 16

> Uniform State requirements for controlling wastes from the watercraft under such State's jurisdiction should be adopted. These requirements should generally conform with the requirements approved by the conferees to the Lake Michigan (Four State) Enforcement Conference. Commensurate interstate requirements controlling the discharge of wastes from commercial vessels should be the responsibility of the Federal Government. The States and the FWPCA are requested to report on this recommendation to the conferees at the next conference session.

As previously reported, the Michigan Water Resources Commission in January 1968 adopted rules and regulations to control pollution from marine toilets on watercraft. The rules do not allow the macerator-chlorinator and do authorize the use of holding tanks or incinerators. The rules became effective January 1, 1970 and public acceptance of this program has generally been encouraging. Private marina operators are beginning to install pump-out stations and treatment facilities where needed and the Michigan Waterways Commission has accelerated its program to provide similar facilities at state harbors of refuge on the Great Lakes. Two state assisted marinas (one at Marquette and one at Ontonagon) are planning to install pump-out stations on Lake Superior.

RECOMMENDATION 17

> The dumping of polluted dredged material into Lake Superior be prohibited.

Act 247, Public Acts of 1955, as amended, authorized the former Department of Conservation to regulate the deposition of materials on state bottom lands. All requests for deposition of materials on such bottom lands are evaluated to determine, prior to the issuance of a permit, whether the material to be deposited contains substances which will cause pollution.

RECOMMENDATION 18

> Programs be developed by appropriate State and Federal agencies to control soil erosion in the Basin. The Wisconsin conferees will, before the next session of the conference, distribute information to the other conferees concerning the action plan developed by the Red Clay Interagency Committee, and will report on the activities of the Red Clay Interagency Committee at the next conference session. Following this report the conferees will give this matter further consideration with a view toward making specific recommendations.

Under the authority vested in the Department of Natural Resources to protect and conserve the natural resources of the state, permits to allow the construction of culverts, bridges, road improvement projects involving public waters and structures affecting navigation must be issued under Act 211, Public Acts of 1965 by the Hydrological Survey Division of the Bureau of Water Management. This same Division issues permits when underground utility projects are to cross or be within 50 feet of a stream, lake or reservoir. The objective is to insure good construction practices so that watercourses are protected from siltation and unreasonable obstruction to flow. Portions of the "Handbook of Specifications for the Protection of Natural Resources" which outlines procedures to prevent siltation are presented in Appendix O.

Under provisions of Act 296, Public Acts of 1936 Michigan has been divided into 82 soil conservation districts. In the Lake Superior basin these districts have developed programs with highway construction firms and utilities to help reduce erosion during construction. Similar programs are being developed to deal with subdividers and shopping center developers. The districts urge land owners to have provisions written into easements that require pipeline companies to restore topsoils after the completion of construction.

RECOMMENDATION 19

The discharge of visible oil from any source be eliminated.

Discharges which cause visible films of oil, gasoline or related materials on public waters are not permitted under any of the water uses listed in the Interstate Water Quality Standards adopted by the Michigan Water Resources Commission on June 28, 1967.

There are no known potential sources of major spills of oil or other hazardous materials in the Michigan portion of the Lake Superior basin.

Changes in Other Programs

Michigan's Clean Water Bond Program

The bond program that was described in Chapter 1 of Michigan's report to the first session has gotten underway. In June 1969 the Michigan State Legislature passed implementing legislation to provide for spending $285 million of the bond proceeds for sewage treatment works and intercepting sewers. In July 1969 implementing legislation was passed to authorize the use of the remaining $50 million for grants to assist in financing construction of collecting sewers.

A priority list of projects has been developed and has been approved by the Commission and the Legislature. At each monthly meeting of the Commission a report is presented which lists changes in the status of grant offers and developments since the previous month's meeting and summarizes all action to date. The report submitted at the April 1970 meeting is included in Appendix P.

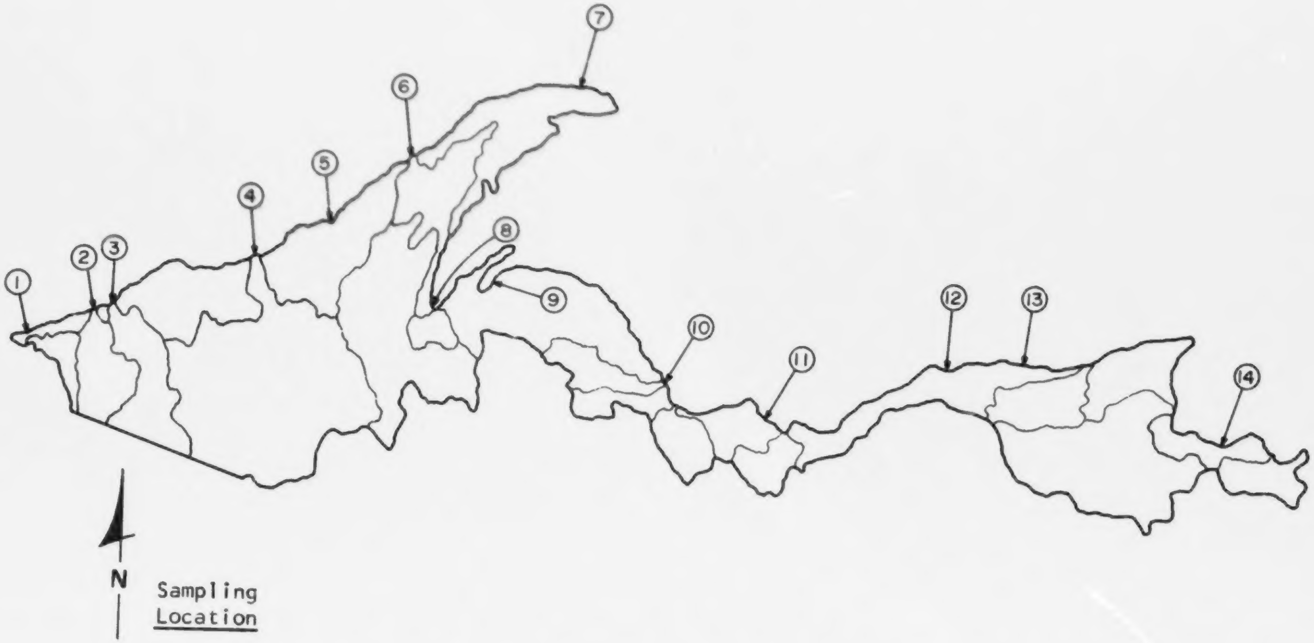
Water Use Designation for Upper Peninsula Waters Previously Exempted

After issuance of the Attorney General's Opinion, Number 4590 described in Chapter 1 on Michigan's report to the first session, the Michigan Water Resources Commission held a public hearing on August 20, 1969 on the proposed water use designations for those waters previously exempted. The recommendations resulting from the hearing and previous staff recommendations were adopted by the Commission on November 19, 1969 and are presented in Appendix Q.

APPENDIX A

Bacteriological Data for Lake Superior Waters Along Michigan's Coastline

MAP I
LAKE SUPERIOR
BEACH SAMPLING LOCATIONS



Sampling Location

1. Little Girls Pt. Park
2. Black River Park
3. Porcupine Mts. State Park
4. Ontonagon Twp. Park
5. Stanford Twp. Park
6. McLain State Park
7. Ft. Wilkins State Park
8. Baraga State Park
9. Arvon Twp. Park
10. Marquette
11. Munising
12. Grand Marais
13. Lake Superior Camp Grounds
14. Bay View

TABLE I

SUMMARY OF BACTERIOLOGICAL DATA FOR LAKE SUPERIOR WATERS ALONG MICHIGAN'S UPPER PENINSULA COASTLINE

Sampling Location	1967 Results				1968 Results				1969 Results			
	Min.	Max.	Geo. Mean	No. of Samples	Min.	Max.	Geo. Mean	No. of Samples	Min.	Max.	Geo. Mean	No. of Samples
1. Little Girls Pt. Park	230	930	462	2	36	1,500	246	4	30	230	51	6
2. Black River Park	230	230	230	2	1,500	24,000	4,337	4	9	930	98	6
3. Porcupine Mts. State Park	230	930	385	5	36	2,300	287	8	73	750	164	6
4. Ontonagon Twp. Park	230	230	230	2	< 30	2,300	313	4	30	230	71	6
5. Stanford Twp. Park	230	230	230	2	< 30	430	130	4	30	230	52	6
6. McLain State Park	< 30	230	41	7	< 30	1,500	110	8	30	36	32	6
7. Ft. Wilkins State Park	< 30	210	52	6	< 30	930	42	12	30	230	43	6
8. Baraga State Park	< 30	930	206	4	230	2,300	822	4	36	2300	169	7
9. Arvon Twp. Park	< 30	1,500	212	2	430	2,300	994	2	30	73	37	6
10. Marquette	< 30	9,300	527	2	73	2,300	237	8	30	4300	181	6
11. Munising	< 30	91	519	2	< 30	24,000	684	8	30	230	57	6
12. Grand Marais	91	91	91	1	< 30	< 30	30	3	3	360	36	6
13. Lake Superior Camp Grounds	91	430	198	2	< 30	360	63	6	3	930	52	6
14. Bay View	< 30	91	53	2	< 30	750	80	8	3	230	49	6

Note: Results expressed as MPN per 100 ml.

APPENDIX B

Radioactivity Sample Results

RADIOACTIVITY SAMPLE RESULTS
WATER INTAKE
MARQUETTE, MICHIGAN
MICROMICROCURIES / LITER

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	Act.	% ±*	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±	Act.	% ±
1959	0	--	2	80	0	--			0	--	0	--	0	--	0	--	0	--			6	140	5	35
1960	0	--	0	--	3	53	4	45			3	60	0	--			0	--	0	--	0	--	0	--
1961	0	--	0	--	0	--	0	--	0	--	0	--	0	--	0	--	4	53	6	28	4	53	7	23
1962	4	53	4	53	0	--	3	53	0	--	11	16	0	--	0	--	5	37	19	10	0	--	0	--
1963	0	--	6	28	4	53	0	--	7	28	15	12	10	19	8	23			4	53	0	--	0	--
1964	2	105	4	53	<1	--					<1	--	<1	--	8	28	4	53	<1	--	<1	--	6	28
1965	6	37	<1	--	6	37	<1	--	<1	--	<1	--	<1	--			<1	--			<1	--	<1	--
1966	10	23	<1	--	6	37	3	37	<1	--							<1	--	<1	--	4	53	<1	--
1967	4	53			<1	--	<1	--	<1	--	4	53									<1	--		
1968	<1	--			<1	--	<1	--																
1969			0				0								6	53							0	

* Probable Error

APPENDIX C

Water Quality Monitoring Program

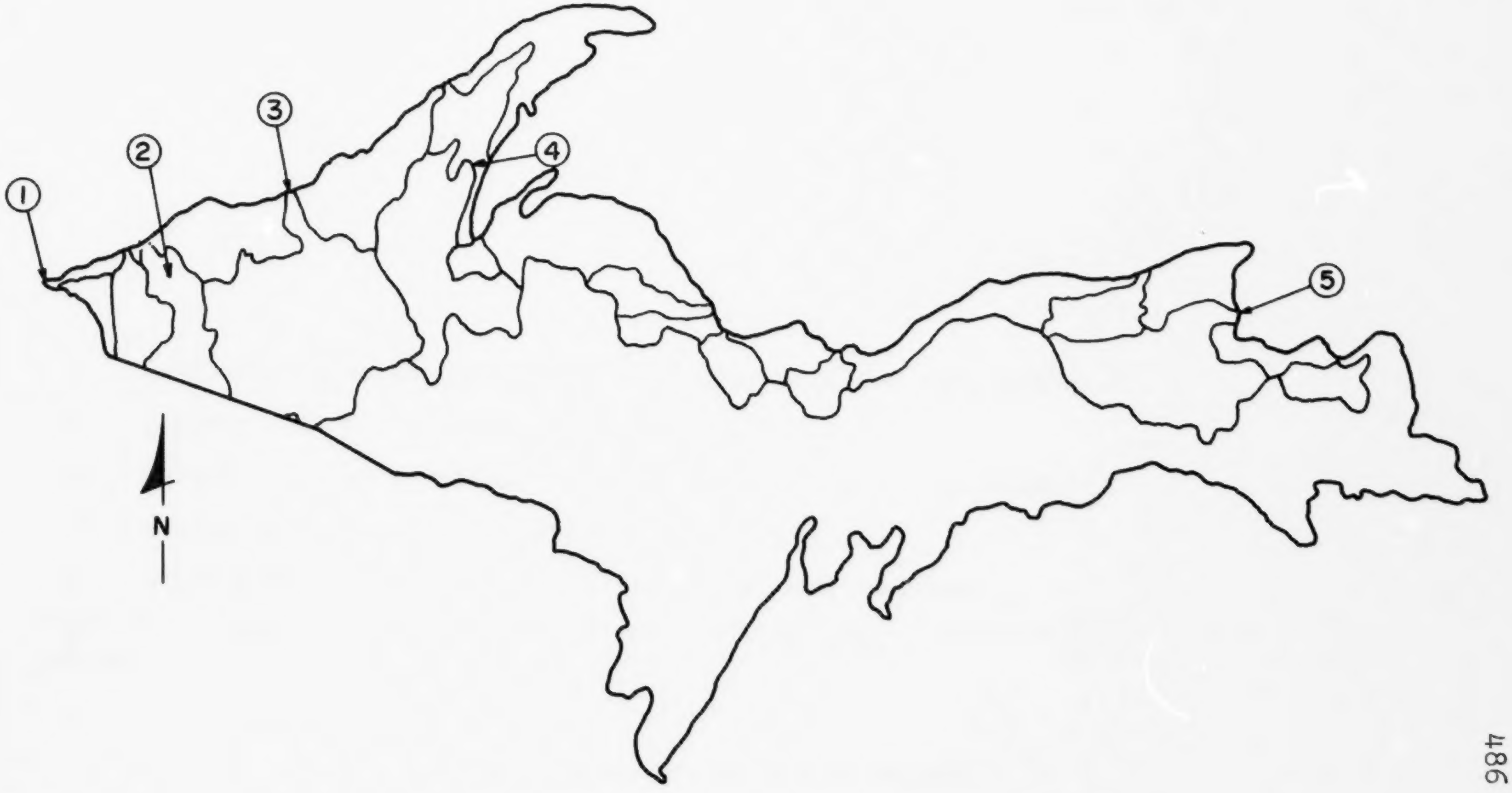
Tributary Water Quality Station Description

Station No.	River	Location
1.	Montreal River near Saxon	Co. Road 505 Bridge
2.	Presque Isle River North of Tula	M-28 Bridge
3.	Ontonagon River in Ontonagon	State Highway M-64 Bridge
4.	Sturgeon River near Chassell	Bridge on U.S.-41
5.	Tahquamenon River near Paradise	State Highway M-123 Bridge

MAP 1

STATE OF MICHIGAN
MICHIGAN PORTION

LAKE SUPERIOR DRAINAGE BASIN
STATIONS IN WATER QUALITY MONITORING PROGRAM



TRIBUTARY WATER QUALITY MONITORING
LAKE SUPERIOR BASIN
CHEMICAL AND PHYSICAL MEASUREMENTS ON GRAB SAMPLES
1969

	MONTREAL			PRESQUE ISLE			ONTONAGON			STURGEON			TAHQUAMENON		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
Temp. °C	23.5	0.0	9.1	23.0	0.0	8.7	24.0	0.0	9.0	25.0	0.0	9.7	23.0	0.0	9.3
DO	14.0	7.4	11.1	12.8	5.9	10.5	13.6	8.6	10.8	12.6	9.0	10.2	13.4	6.8	10.8
BOD_5	6.8	1.0	3.5	5.7	0.8	2.7	8.3	0.8	3.1	3.5	0.8	2.7	4.2	0.8	2.2
pH	8.8	6.9	7.7	8.7	7.0	7.6	8.9	7.0	7.7	8.7	7.1	7.7	8.6	7.2	7.7
SS	27	0	9	19	0	6	240	3	48	34	0	9	15	1	7
SVS	21	0	6	12	0	4	12	0	7	7	0	4	10	0	4
TDS	91	69	79	91	64	78	124	78	95	112	52	92	164	66	113
Cond (u MHO)	140	50	92	140	40	93	170	60	21	160	40	118	180	40	122
NO_3-N	0.55	0.10	0.24	0.30	0.00	0.14	0.21	0.00	0.12	0.20	0.00	0.11	0.10	0.02	0.05
NH_3-N	0.25	0	0.07	0.22	0.00	0.05	0.25	0.00	0.05	0.45	0.00	0.05	0.30	0.00	0.12
Total KJEL-N	0.97	0.40	0.65	0.79	0.10	0.44	0.71	0.30	0.54	1.40	0.40	0.57	0.60	0.24	0.47
Sol. Ortho PO_4-P	0.30	0.01	0.08	0.07	0.00	0.01	0.07	0.00	0.02	0.03	0.00	0.01	0.05	0.00	0.02
Total PO_4-P	0.72	0.04	0.16	0.09	0.02	0.05	0.31	0.02	0.10	0.27	0.02	0.06	0.10	0.02	0.05
Ca	14.0	10.0	12.0	13.0	6.0	9.5	20.0	11.0	15.5	26.0	6.0	17.5	22	6	15
Mg	4.0	2.7	3.4	5.0	2.0	3.1	6.1	3.0	5.0	7.0	2.0	5.0	6.1	3.0	4.8
Na	5.0	2.3	3.4	6.5	1.6	3.2	5.0	1.8	3.1	4.0	2.0	2.8	2.3	1.0	1.8
K	1.2	0.7	0.9	1.2	0.4	0.8	2.0	0.7	1.3	1.4	0.6	1.0	2.0	0.4	1.1
Fe	0.67	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mn	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cr^{+6}	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cu	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zn	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cl	8	1	4	4	0	2	5	0	2	5	0	2	4	0	2
SO_4	23	8	--	23	--	--	16	--	--	16	--	--	26	--	--
F	0.11	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CN	0.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hard.-$CaCO_3$	62	28	43	75	28	53	85	40	64	96	24	67	95	26	68
Alkal.-$CaCO_3$	52	20	33	88	20	44	76	30	57	80	20	57	80	20	54
Color	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Turb. (J.C.U.)	7	2	4	15	2	5	110	10	35	11	3	6	6	3	4
Phenol	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tot. Coliform (Cts./100 ml)	11,000	200	1,426	1,200	100	518	35,000	600	2,940	1,400	100	360	800	100	174
Fec. Coliform (Cts./100 ml)	490	10	56	150	10	37	260	10	48	100	10	22	20	10	11
Tot. Coliform (MPN/100 ml)	24,000	24,000	--	9,300	150	--	21,000	230	--	2,300	430	--	930	30	109

NOTE: All concentrations in mg/l except pH and color and as otherwise noted.
Averages are arithmetic averages except coliform organisms which are geometric averages.

APPENDIX D

Domestic Water Intakes

STATE OF MICHIGAN
MICHIGAN PORTION
LAKE SUPERIOR DRAINAGE BASIN
SAMPLE INFORMATION — RAW WATER INTAKES

Table 1

1969

Intake Sampled	Total Coliform Counts/100 ml	Fecal Coliform Counts/100 ml	Temp. °C	DO	BOD	SS	TDS	pH	NO_3-N	Cl	NH_3-N	$SOPO_4$	TPO_4	Fe	SO_4	Alkal-inity $CACO_3$	F	Cond. μ MHO
1 White Pine Mine	600	<10	15	9.4	1.4	3	--	8.0	0.15	0	0.00	0.00	0.19	0.1	22	44	0.09	120
2 Calumet	<100	<10	10	8.8	1.1	0	--	8.0	0.55	38	0.00	0.03	0.11	0.3	23	96	0.09	360
3 Eagle Harbor	<100	<10	14	13.4	3.4	1	--	8.2	0.35	2	0.00	0.00	0.06	0.2	21	56	0.00	120
4 Copper Harbor	<100	<10	14	9.8	1.2	4	--	8.2	0.20	0	0.17	0.03	0.04	0.1	20	44	0.00	95
5 Gay	<100	<10	11	5.2	0.4	1	--	7.3	0.20	1	0.07	0.04	0.04	1.2	21	64	0.09	140
6 Pequaming	100	<10	21	12.0	3.5	4	62	8.3	0.30	2	0.10	0.02	0.05	0.0	4	40	0.10	85
7 Baraga	<100	<10	19	12.8	3.5	5	56	8.2	0.40	0	0.10	0.00	0.02	0.0	3	44	0.10	85
8 L'Anse	<100	<10	17	12.8	3.5	5	56	8.1	0.40	0	0.00	0.03	0.03	0.0	2	40	0.10	85
9 Marquette	<100	<10	19	13.0	4.4	3	56	8.2	0.25	4	0.10	0.02	0.05	0.2	5	44	0.10	85
10 Munising	1500	<10	19	12.2	3.3	2	56	8.1	0.30	0	0.10	0.03	0.05	0.0	7	44	0.05	85
Arithmetic Average			16	10.9	2.6	3	57	8.1	0.30	5	0.06	0.02	0.06	0.2	13	52	0.07	126

Table 2

1968

Intake Sampled	Total Coliform MPN/100 ml	DO	BOD_5	SS	TDS	pH	NO_3-N	Cl	NH_3-N	$SOPO_4$	TPO_4	Fe	Ca	Mg	Na	K	SO_4	Alkal-inity $CaCO_3$	Hard-ness $CaCO_3$	F	Color (units)
1 White Pine Mine	< 30	11.4	1.6	1	42	7.4	0.25	0	0.0	0.00	0.00	0.0	14	2	1.4	0.5	2	44	42	0.20	5
2 Calumet	36	10.0	0.6	1	72	6.5	0.70	2	0.0	0.22	0.23	0.0	17	2	2.5	0.9	5	46	50	0.15	10
3 Eagle Harbor	< 30	12.2	0.4	3	54	7.3	0.25	0	0.0	0.00	0.00	0.0	15	1	1.2	0.4	1	44	42	0.10	5
4 Copper Harbor	< 30	12.2	0.4	7	70	7.4	0.20	0	0.0	0.00	0.00	1.7	13	1	1.6	0.5	2	44	38	0.10	5
5 Gay	< 30	8.8	1.0	4	84	6.8	0.25	0	0.0	0.00	0.00	0.4	17	2	2.5	1.1	5	56	52	0.15	10
6 Pequaming	< 30	11.6	2.4	2	44	7.3	0.20	0	0.0	0.00	0.00	0.1	15	1	1.6	0.5	4	44	42	0.15	5
7 Baraga	< 30	10.4	0.6	5	68	7.2	0.20	0	0.0	0.00	0.00	0.0	14	1	1.4	0.5	2	42	40	0.10	5
8 L'Anse	< 30	10.6	0.4	1	82	7.3	0.20	0	0.0	0.00	0.00	0.1	14	2	1.4	0.5	3	42	42	0.15	5
9 Marquette	< 30	----	---	2	56	7.3	0.25	0	0.0	0.00	0.00	0.0	14	1	1.4	0.5	3	42	40	0.10	5
10 Munising	< 30	10.4	0.6	2	62	7.4	0.20	0	0.0	0.00	0.00	0.0	14	1	1.2	0.5	1	42	40	0.20	0
Arithmetic Average		10.8	0.9	3	63	7.2	0.27	0	0.0	0.02	0.02	0.2	15	1	1.6	0.6	3	45	43	0.14	5.5

Table 3

1967

Intake Sampled	DO	BOD_5	SS	TDS	pH	NO_3-N	Cl	NH_3-N	$SOPO_4$	Fe	Ca	Mg	Na	K	SO_4	Alkal-inity-$CaCO_3$	Hard-ness $CaCO_3$	CN	Cr^{+6}	As	Mn	Cu	F	Zn
1 White Pine Mine	13.1	1.6	2	42	7.8	0.25	0	0.0	0.00	0.0	16	2	1.8	0.4	4	45	48	0.00	0.00	0.00	0.0	0.0	0.10	0.0
2 Calumet	13.0	2.5	5	50	7.8	0.20	0	0.0	0.00	0.1	14	3	1.4	0.3	4	45	48	0.00	0.00	0.00	0.0	0.0	0.10	0.0
3 Eagle Harbor	12.5	1.2	1	65	7.7	0.25	0	0.0	0.00	0.2	14	4	1.6	0.3	3	50	50	0.00	0.00	0.00	0.0	0.0	0.10	0.0
4 Copper Harbor	11.4	1.8	0	50	7.7	0.25	0	0.0	0.00	0.0	14	4	1.6	0.3	6	50	52	0.00	0.00	0.00	0.0	0.0	0.10	0.0
5 Gay	6.4	0	0	70	7.3	0.25	0	0.0	0.00	0.3	15	4	2.5	0.6	5	55	54	0.00	0.00	0.00	0.0	0.0	0.10	0.0
6 Pequaming	10.8	2.6	4	54	7.9	0.70	2	0.0	0.00	0.1	14	4	1.8	0.3	3	45	50	0.00	0.00	0.00	0.0	0.0	0.15	0.0
7 Baraga	12.8	2.8	0	46	7.7	0.20	0	0.0	0.20	0.1	14	4	1.4	0.4	4	45	50	0.00	0.00	0.00	0.0	0.0	0.10	0.0
8 L'Anse	12.8	2.6	5	46	7.6	0.70	0	0.0	1.40**	0.0	15	3	1.8	1.4	7	40	50	0.00	0.00	0.00	0.0	0.0	0.15	0.0
9 Marquette	11.4	2.7	2	60	7.9	0.20	0	0.0	0.00	0.0	13	4	1.1	0.2	5	45	50	0.00	0.00	0.00	0.0	0.0	0.05	0.0
10 Munising			2	70	7.4	0.20	0	0.0	0.00	0.1	14	2	1.4	0.3	10	40	44	0.00	0.00	0.00	0.0	0.0	0.05	0.0
Arithmetic Average	11.6	2.0	2	55	7.7	0.3	0	0.0	0.16	0.1	14	3	1.6	0.5	5	46	50	0.00	0.00	0.00	0.0	0.0	0.10	0.0

NOTE: All results are expressed as mg/l except pH and as otherwise noted.
Sample results were obtained from grab samples taken during summer of 1967, 1968 & 1969.

** Source of high $SOPO_4$ unknown.

APPENDIX E

Montreal River Basin

Interstate Water Quality Monitoring
Montreal River
Chemical and Physical Measurements on Grab Samples
July 16, 1969

	Co. Rd. 505 Bridge 1/2 Mile Upstream From Mouth	Co. Rd. Bridge W. Side Sec. 5, 5 Miles N.W. of Ironwood	U.S. 2 Bridge, Ironwood	Co. Rd. Bridge Between Ironwood & Hurley	Co. Rd. Bridge, S. Edge of Ironwood	Co. Rd. Bridge to VanBuskirk, Wisconsin
Time	1340	1310	1250	1240	1225	1205
Temp °C	23	21	21	21	20.5	20
D.O.	9.4	7.6	6.4	6.2	6.0	6.0
BOD_5	2.0	5.0	3.2	2.8	3.4	3.4
pH	8.8	8.2	8.0	7.9	7.7	7.7
TS	118	90	86	73	101	101
SS	18	18	22	13	11	11
SVS	8	9	14	9	11	5
TDS	100	72	64	60	90	90
NH_3-N	0.10	0.16	0.09	0.03	0.07	0.09
NO_3-N	0.35	0.30	0.15	0.20	0.20	0.20
Sol. Ortho. PO_4-P	0.08	0.09	0.03	0.01	0.01	0.01
Total PO_4-P	0.18	0.28	0.16	0.11	0.09	0.08
Ca	10	8.8	8.0	7.2	7.2	7.2
Mg	2.7	2.4	1.9	1.9	1.9	1.9
Na	2.3	1.4	1.4	1.0	1.2	1.4
K	0.8	0.7	0.7	0.6	0.6	0.7
Fe	0.67	1.4	1.0	0.67	0.89	1.0
Mn	0.0	0.0	0.0	0.0	0.0	0.00
Cr^{+6}	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.00	0.00	0.00	0.00	0.00	0.00
Zn	0.00	0.00	0.00	0.00	0.00	0.00
Cl	4	2	3	2	2	3
SO_4	8	9	7	8	8	6
F	0.11	0.09	0.09	0.09	0.00	0.00
CN	0.00	0.00	0.00	0.00	0.00	0.00
Hard.-$CaCO_3$	36	32	28	26	26	26
Alk.-$CaCO_3$	32	28	24	20	20	24
Color	70	120	120	120	140	140
Phenol	0.00	0.00	0.00	0.00	0.00	0.00
AD	0.0	0.0	0.0	0.0	0.0	0.0
Total Coliform (MPN/100 ml.)	--	46,000	140,000	9,300	46,000	110,000

NOTE: All concentrations in Mg/l except pH and as otherwise noted.

APPENDIX F

Inshore Phytoplankton Analyses of Upper Peninsula Samples

INSHORE PHYTOPLANKTON ANALYSES OF UPPER PENINSULA SAMPLES
FROM 7/22/89-8/25/69

LAKE SUPERIOR

Stations Number	Station Location	Date	Kinds of Algae per ml. Coccoid Blue Green	Filamentous Blue Green	Coccoid Green	Filamentous Green	Flagellate	Diatoms Centric	Diatoms Pennate	Desmids	Total Algae	Dominant Genera	Temp. °C
B03940	Green Park in front of changing rooms, Ontonagon Co.	7/22/69	0	0	6	0	7	10	9	0	32	Cyclotella	15.5
		8/11/69	0	0	0	0	0	10	16	0	26	Cyclotella	16
		8/26/69	0	0	0	0	0	0	40	0	40	Cyclotella	19
B04000	Esrey State Park on M-26, Keweenaw Co.	7/23/69	0	0	0	3	3	10	170	0	186	Diatoma	10
		8/12/69	0	0	0	0	0	24	165	0	189	---	17
		8/27/69	0	0	0	0	3	38	104	0	145	Diatoma	17
B04120	Autrain Bay State Roadside Park, Middle of Bathing Area, Alger Co.	9/28/69	0	0	0	0	0	10	107	0	117	Navicula	17
		8/20/69	0	0	0	0	0	14	26	0	40	Cymbella	
B04170	Bayview Campgrounds, USFS Campgrounds, Lakeshore Dr. Chippewa Co.	7/28/69	0	0	0	0	3	3	180	3	195	Diatoma	15
		8/20/69	0	0	0	0	0	24	165	0	189	Diatoma	16.5

APPENDIX G

Notification to Municipalities of Requirements for Secondary Treatment

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
AUGUST SCHOLLE
Chairman
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WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
RALPH A. MAC MULLAN, Director

WATER RESOURCES COMMISSION
JOHN E. VOGT
Chairman
STANLEY QUACKENBUSH
Vice Chairman
GERALD E. EDDY
JOHN P. WOODFORD
JIM GILMORE
GEORGE F. LIDDLE
JOHN H. KITCHEL, M.D.

April 7, 1970

Gentlemen:

On February 5, 1968, we transmitted to you a copy of the Resolution adopted by the Water Resources Commission in October 1967 which calls for removal of phosphorus compounds from waste discharges to waters of the state by June 1, 1977. It was pointed out in that letter that June 1, 1977 was an outside date for meeting this objective and that earlier compliance would be sought wherever possible.

On May 13-15, 1969 and September 30 and October 1, 1969, a Federal-State Conference on the pollution of Lake Superior and that portion of the tributary basin lying within the United States was held at Duluth, Minnesota. The recommendations of that Conference, which this Commission has committed itself to implement, call for waste treatment to achieve at least 80% reduction of total phosphorus contained in municipal discharges by not later than January 1975.

In addition, the recommendations call for secondary biological waste treatment or its equivalent to be provided by all municipalities discharging directly to or affecting Lake Superior or its bays or harbors or interstate tributary streams. Such treatment is to be provided by not later than January 1974. The ______________ is not now providing secondary treatment and, therefore, has an obligation to do so by the prescribed date, January 1974. We will expect the _________ to, concurrently with the addition of secondary treatment, provide facilities for achieving a minimum of 80% removal of total phosphorus from its wastes.

It is the Commission's policy to encourage voluntary compliance with pollution control requirements, however, it desires that such voluntary programs proceed in an orderly manner in accordance with stipulated time schedules to assure that its committment for implementing the recommendations of the Federal-State Conference is met timely. If it is the desire of the _________ to proceed on this basis, a letter transmitting formal verification of such intent, by resolution of your governing body, should be filed with the Commission within the next 30 days. Upon receipt of such verification, we will develop an appropriate form of Stipulation between the ________ and the Water Resources Commission incorporating the necessary terms of treatment accomplishment and performance schedule.

MICHIGAN
THE GREAT LAKE STATE

If such verification is not received, it may be expected that the Commission will initiate procedures leading to the issuance of a Final Order of Determination to assure that the requirements of the Lake Superior Enforcement Conference are met.

We look forward to hearing from you in this matter by not later than May 1, 1970. Do not hesitate to call us if there are any questions.

Very truly yours,

WATER RESOURCES COMMISSION

Ralph W. Purdy
Executive Secretary

RJC:ms

cc: C. Courchaine
J. Bal

bcc: R. J. Courchaine

APPENDIX H

1969 Bacteriological Quality of Municipal Wastewater Treatment Plant Effluents

Bacteriological Data
for
Municipalities
in Lake Superior Basin
1969

	January	February	March	April	May	June	July	August	September	October	November	December
Houghton-Hancock												
Max.	9	23	15	2,100	430	93	430	93	43	43	4	93
Min.	<3	<3	<3	4	4	<3	4	< 3	<3	<3	<3	< 3
Ave.	4	9	5	28	29	25	23	12	12	11	3	17
No. of Samples	7	4	6	8	6	7	9	7	8	5	4	6
Ironwood												
Max.	2,500	1,200	800	800	1,100	900	24,000	700	800	1,500	800	1,400
Min.	200	100	100	500	100	500	14,000	200	200	500	500	200
Ave.	694	372	349	632	375	763	--	280	464	881	434	336
No. of Samples	8	4	6	2	4	5	2	9	8	11	7	8
Ishpeming												
Max.	430	930	430	430	930	750	750	950	750	910	750	150
Min.	7	4	75	91	350	9	93	<3	93	<3	4	73
Ave.	93	90	170	238	505	146	228	234	350	121	121	102
No. of Samples	8	8	8	8	6	8	10	5	6	10	6	4
Ishpeming Twp. A												
Max.	--	930	--	--	730	730	1,500	910	750	430	210	910
Min.	--	<3	--	--	360	<3	<3	360	150	36	36	<3
Ave.	--	84	--	--	513	130	177	621	287	148	178	572
No. of Samples	--	3	--		2	4	4	3	3	3	3	3
Ishpeming Twp. B												
Max.	--	930	--	--	910	730	730	910	910	430	430	910
Min.	--	91	--	--	<3	<3	<3	360	<3	<3	73	360
Ave.	--	269	--	--	52	19	159	490	99	58	168	513
No. of Samples	--	3	--	--	2	2	5	3	3	3	3	3
L'Anse												
Max.	4	15	4,600	4	210	>14,000	>140,000	140,000	1,400,000	11,000	>14,000	>14,000
Min.	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Ave.	3	5	6	3	3	10	40	174	49	11	79	16
No. of Samples	9	10	12	12	12	13	12	12	13	12	12	11
Marquette												
Max.	4,600	11,000	11,000	4,600	11,000	4,600	11,000	4,600	4,600	--	--	--
Min.	73	<30	<30	<36	<30	<30	<30	36	< 30	--	--	--
Ave.	1,368	738	1,603	641	379	275	202	606	536	--	--	--
No. of Samples	22	22	23	22	29	26	29	19	18	--	--	--
Munising												
Max.	350	11,000	14,000	14,000	11,000	11,000	1,400	93	23,000	>14,000	750	>140,000
Min.	9	9	<3	<3	<3	<3	<3	<3	<3	4	<3	36
Ave.	29	398	172	394	264	70	18	14	609	61	26	7,152
No. of Samples	10	11	11	9	12	10	11	13	12	20	10	12
Ontonagon												
Max.	--	460	4	<3	150	<3	460	460	460	1,100	1,100	1,100
Min.	--	<3	<3	<3	<3	<3	<3	<3	4	93	<3	<3
Ave.	--	11	3	<3	50	<3	21	30	101	384	36	202
No. of Samples	--	4	4	5	4	4	5	4	4	4	4	4
Watersmeet												
Max.	11,000,000	14,000,000	>14,000,000	11,000,000	43,000,000	4,600,000	2,400,000	14,000,000	14,000,000	<3,000	4,600	1,500
Min.	4,300,000	140,000	1,500,000	2,100,000	11,000,000	<300	930,000	<3,000	<30	<30	<3	23
Ave.	8,043,000	2,537,700	3,836,850	5,848,600	17,449,350	152,563	1,833,205	145,189	7,700	627	153	154
No. of Samples	3	4	4	5	4	5	4	4	5	4	4	5
White Pine												
Max.	93	43	1,100	43	460	1,100	9	23	240	1,100	93	460
Min.	0	0	0	0	0	0	0	0	0	0	0	7
Ave.	25	10	63	7	29	76	5	7	34	30	31	28
No. of Samples	9	8	8	8	8	8	8	8	8	8	8	9

All bacterial densities are MPNs/100 ml.

APPENDIX I

Notification to Municipalities of Requirements for Phosphorus Removal

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
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HARRY H. WHITELEY

WILLIAM G. MILLIKEN, Governor
DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
RALPH A. MAC MULLAN, Director

WATER RESOURCES COMMISSION
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Vice Chairman
GERALD E. EDDY
JOHN P. WOODFORD
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GEORGE F. LIDDLE
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April 7, 1970

Gentlemen:

On February 5, 1968, we transmitted to you a copy of the Resolution adopted by the Water Resources Commission in October 1967 which calls for removal of phosphorus compounds from waste discharges to waters of the state by June 1, 1977. It was pointed out in that letter that June 1, 1977 was an outside date for meeting this objective and that earlier compliance would be sought wherever possible.

On May 13-15, 1969 and September 30 and October 1, 1969, a Federal-State Conference on the pollution of Lake Superior and that portion of the tributary basin lying within the United States was held at Duluth, Minnesota. The recommendations of that Conference, which this Commission has committed itself to implement, call for waste treatment to achieve at least 80% reduction of total phosphorus contained in municipal discharges by not later than January 1975.

Accordingly, we will expect the ____________ to install and operate facilities for achieving a minimum of 80% removal of the total phosphorus from its wastes by not later than the prescribed date, January 1975.

It is the Commission's policy to encourage voluntary compliance with pollution control requirements, however, it desires that such voluntary programs proceed in an orderly manner in accordance with stipulated time schedules to assure that its committment for implementing the recommendations of the Federal-State Conference is met timely. If it is the desire of the _______ to proceed on this basis, a letter transmitting formal verification of such intent, by resolution of your governing body, should be filed with the Commission within the next 30 days. Upon receipt of such verification, we will develop an appropriate form of Stipulation between the _________ and the Water Resources Commission incorporating the necessary terms of treatment accomplishment and performance schedule.

If such verification is not received, it may be expected that the Commission will initiate procedures leading to the issuance of a Final Order of Determination to assure that the requirements of the Lake Superior Enforcement Conference are met.

MICHIGAN
THE GREAT LAKE STATE

We look forward to hearing from you in this matter by not later than May 1, 1970. Do not hesitate to call us if there are any questions.

Very truly yours,

WATER RESOURCES COMMISSION

Ralph W. Purdy
Executive Secretary

RJC:ms

cc: C. Courchaine
J. Bal

bcc: R. J. Courchaine

STATE OF MICHIGAN

WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES

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April 7, 1970

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Accordingly, we will expect the ______________ to install and operate facilities for achieving a minimum of 80% removal of the total phosphorus from its wastes by not later than the prescribed date, January 1975. Concurrently, with the design of such facilities, the ________ should have its engineers evaluate the need for providing additional treatment in light of the State's Water Quality Standards which have been adopted by the Commission for the intrastate waters receiving the _________ wastewater discharges.

It is the Commission's policy to encourage voluntary compliance with pollution control requirements, however, it desires that such voluntary program proceed in an orderly manner in accordance with stipulated time schedules to assure that its committment for implementing the recommendations of the Federal-State Conference is met timely. If it is the desire of the __________ to proceed on this basis, a letter transmitting formal verification of such intent, by resolution of your governing body, should be filed with the Commission within the next 30 days. Upon receipt of such verification, we will develop an appropriate form of Stipulation between the ___________ and the Water Resources Commission incorporating the necessary terms of treatment accomplishment and performance schedule.

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MICHIGAN
THE GREAT LAKE STATE

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Very trulys yours,

WATER RESOURCES COMMISSION

Ralph W. Purdy
Executive Secretary

RJC:ms

cc: C. Courchaine
J. Bal

bcc: R. J. Courchaine

APPENDIX J

Industrial Surface Water Discharges in the Lake Superior Basin

TABLE I

MICHIGAN'S DIRECT INDUSTRIAL DISCHARGES TO LAKE SUPERIOR

				Discharge Characteristics after Treatment					
Company Name	Product	Location	Treatment	Flow MGD	5-day BOD lbs/day	Suspended Solids lbs/day	1970 Pollution Status Rating	Date of Order of Determination	Remarks
DEL Royal Oak Charcoal				Company has terminated operations.					
Kimberly Clark Corp.	Paper products	Munising	Chemical precipitation and settling Sanitary to city sewers	5.33	---	650	B	None	Control adequate
Marquette Board of Power and Light	Electricity	Marquette	Cooling water-none Ash disposal-lagoon	- No data available -			A A	Sept. 1967	Control adequate
U.P. Generating Co.	Electricity	Marquette	Cooling water-none Ash disposal-lagoon	- No data available - - No data available -			A A	July 1965	Control adequate

TABLE 2

MICHIGAN'S
INDUSTRIAL SURFACE WATER DISCHARGES
LAKE SUPERIOR BASIN

	Company Name	Product	Location	Receiving Stream	Treatment Provided	Discharge Characteristics after Treatment			1969 Pollution Status Rating	Date of Order of Determination	Remarks
						Flow MGD	5-day BOD lbs/day	Suspended Solids lbs/day			
1.	**Montreal River Basin**										
	Superior Packing Company	Meat	Ironwood	Ground water	Septic tank and tile field	- - - - No data available - - - -			B	None	---
DEL	William E. Maki Slaughterhouse								Company has terminated operation		
2.	**Black River Basin**										
DEL	Auvinen's Grocery Slaughterhouse								Business has terminated operation		
3.	**Presque Isle River Basin**										
	- - - - No major industries in basin - - - -										
4.	**Mineral River Basin**										
	White Pine Copper Co.	Copper	White Pine	Native Creek and Mineral River	Chemical precipitation and settling	21.6			A	July 1958	Control adequate
	White Pine Copper Co. Tolfrey Shaft	Copper ore	White Pine	Tolfrey and Argentine Creeks	Secondary treatment for san. sewage				A	Oct. 1966	Control adequate
5.	**Ontonagon River Basin**										
	Hoerner-Waldorf, Inc. Ontonagon Mill Division	Paper	Ontonagon	Ontonagon River	Save-all Sanitary to city sewer	5.5	13,000	4,900	E	None	Taste and Oder Problem
	Ontonagon Valley Co-op Creamery	Milk and cheese	Bruce Crossing	Clear Creek	Haul whey away	- - - - No data available - - - -			B	None	---
	Tom Nordine Laudromat		Bruce Crossing	Ground water	Lagoon	- - - - No data available - - - -			A		Control adequate
6.	**Sleeping River Basin**										
	Lake Superior Engineering Inc.		Winona	Ground water	None	- - - - No data available - - - -			B	March 1967	---
7.	**Portage River Basin**										
	Bosch Brewing Co.	Beer	Houghton	Portage Lake	Settling screens Sanitary-septic tank and tile field	---	585	---	B	None	---
DEL	Calumet & Hecla, Inc. (Ahmeek Mill)								Company has terminated operation		
DEL	Calumet & Hecla, Inc. (Osceola #13 mine)								Company has terminated operation		
8.	**Sturgeon River Basin**										
	- - - - No major industries in basin - - - -										
9.	**Falls River Basin**										
	Celotex Corporation	Building board	L'Anse	Ground water	Lagoon and spray irrigation	0.400	---	---	A	Sept. 1956	Control adequate
	U.P. Power Company	Electricity	L'Anse	Falls River	Cooling water-none Ash disposal-none	--- ---	--- ---	--- ---	A A	Aug. 1958	Control adequate Control adequate
10.	**Dead River Basin**										
	Marquette Board of Power and Light Diesel Plant	Electricity	Marquette	Dead River	None	- - - - No data available - - - -			E	None	Minor oil problem
	Bancroft Dairy	Milk and dairy products	Marquette	Creek and Dead River	Septic tank	050	---	---	E	None	Will be joining Municipal Sewer System 7-1-70

	Company Name	Product	Location	Receiving Stream	Treatment Provided	Discharge Characteristics After Treatment			1969 Pollution Status Rating	Date of Order of Determination	Remarks
						Flow MGD	5-day BOD lbs/day	Suspended Solids lbs/day			
11.	Carp River Basin										
	Cleveland Cliffs Iron Company (Ore Improvement Plant)	Iron ore	Negaunee	Ground water	Settling ponds	.390	---	---	A	May 1957	Control adequate
	Cleveland Cliffs Iron Company (Pioneer Pellet Plant)	Iron ore pellets	Negaunee	Ground water	Settling ponds	---	---	---	A	Same Order	Control adequate
	Cleveland Cliffs Iron Company (Eagle Mills Pellet Plant)	Iron ore pellets	Negaunee	Ground water	Settling ponds	---	---	---	A	Same Order	Control adequate
	Northern Automatic Electric Foundry	Iron castings	Ishpeming	Ground water	Settling and cooling ponds	- - - - No data available - - - -			B	Oct. 1968	New pond
12.	Chocolay River Basin										
	James Sicotte Laundromat		Harvey	Ground water	Lagoon	- - - - No data available - - - -			B	None	---
13.	Au Train River Basin										
	- - - - - - - - No major industries in basin - - - - - - - -										
14.	Two-Hearted River Basin										
	- - - - - - - - No major industries in basin - - - - - - - -										
15.	Tahquamenon Basin										
DEL	Somers Slaughterhouse								Company has terminated operation		
16.	Waiska River Basin										
	- - - - - - - - No major industries in basin - - - - - - - -										

Industries with Discharges in Minor Drainage Areas

DEL	Calumet & Hecla, Inc. (Centennial #3 Mine)	Company has terminated operation
DEL	Calumet & Hecla, Inc. (Centennial #6 Mine)	Company has terminated operation
DEL	Calumet & Hecla, Inc. (Allouez #3 Mine)	Company has terminated operation
DEL	Calumet & Hecla, Inc. (Kingston Mine)	Company has terminated operation

APPENDIX K

Rules of Procedure for Industrial Waste Treatment Plant Operators

DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES COMMISSION

WASTE TREATMENT PLANT OPERATORS
Rules of Procedure
Rules 21 - 29

Filed with Secretary of State, January 26, 1970.

(By authority conferred upon the water resources commission by section 2 of Act No. 245 of the Public Acts of 1929, as amended, being section 323.2 of the Compiled Laws of 1948.)

R 323.21. Purpose.

Rule 21. Section 6 a of Act No. 245 of the Public Acts of 1929, as added by Act No. 209 of the Public Acts of 1968, being section 323.206a of the Compiled Laws of 1948, requires that every industrial or commercial entity which discharges liquid wastes into any public lake or stream shall have waste treatment facilities under the specific supervision and control of persons who have been certified by the water resources commission as being properly qualified to operate the facilities. These rules set forth the requirements for certification of such operators.

R 323.22. Definitions.

Rule 22. (1) "Board" means the board of examiners established by the commission.

(2) "Certificate" means a document issued by the commission attesting that a person is properly qualified to operate or supervise the operation of certain designated waste treatment facilities.

(3) "Commission" means the water resources commission, department of natural resources.

(4) "Owner" means an industrial or commercial entity which discharges liquid wastes into any public lake or stream.

(5) "Public lake or stream" means a lake or stream which is being used or is capable of being used by the public or contains fish which are the property of the public.

R 323.23. Classification of waste treatment facilities.

Rule 23. (1) Each waste treatment facility shall be classified by the commission as to type. The commission shall notify the owner of the waste treatment facility of its classification by issuing a certificate of classification. An owner who objects to the assigned classification may appeal to the commission in accordance with the commission's rules of procedure. Upon appeal, the commission shall schedule a hearing and request the owner to present evidence to support his claim. After this hearing, the commission shall determine the proper waste treatment facility classification.

(2) Classifications shall be of 3 types, described as physical, chemical and biological. Each of these classifications shall be further sub-divided into at least 3 sub-classifications with the more complex facilities assigned the higher numbers.

EXAMPLES OF WASTE TREATMENT PLANT CLASSIFICATIONS

A. PHYSICAL

Sub-Classification No. 1

- Plain sedimentation
- Screening
- Spray pond
- Skimming
- Gravity separation
- Flotation
- Impoundment - regulated discharge

Sub-Classification No. 2

- Filtration
- Thermo control - cooling towers
- Incineration - land disposal
- Radioactivity monitoring
- Air flotation
- Gas stripping
- Centrifuging

Sub-Classification No. 3

- wet oxidation
- Membrane filtration

B. CHEMICAL

Sub-Classification No. 1

- Sludge conditioning
- Neutralization
- Evaporation - condensation
- Adsorption
- Absorption

Sub-Classification No. 2

- Chemical coagulation
- Precipitation
- Emulsion breaking
- Ion exchange

Sub-Classification No. 3

Chemical oxidation - reduction
Chemical recovery

C. BIOLOGICAL

Sub-Classification No. 1

Extended aeration
Aerated lagoons
Natural stabilization basin

Sub-Classification No. 2

Disinfection
Trickling filters
Aerobic and anaerobic digestion

Sub-Classification No. 3

Activated sludge

R 323.24. Board of examiners.

Rule 24. The commission shall appoint a five-member board of examiners, of which 1 member shall be a member of the staff of the commission, 1 shall be a member of the staff of the Michigan department of public health, 1 shall be an owner of a commercial or industrial enterprise which operates a waste treatment facility or an employee of such an owner, 1 shall be a holder of a certificate to operate or supervise the operation of a waste treatment facility, and 1 shall be chosen at large. Of the members first appointed, 1 shall be appointed for a term of 1 year, 2 for terms of 2 years and 2 for terms of 3 years. Thereafter, each member shall be appointed for a term of 3 years. At its first meeting in each calendar year, the board shall select from its membership a chairman and such other officers as may be needed to conduct its business. Members of the board shall be reimbursed for their actual and necessary expenses in transacting board business.

R 323.25. Applications and examinations.

Rule 25. (1) A person desiring to be certified in 1 or more of the classifcations shall file an application with the commission at least 30 days before the established date of the examination on an application form provided by the commission. The information included therein shall constitute a part of the examination.

(2) The board shall, under the direction of the commission, examine applicants for certification in order to determine their ability and qualifications, at such times and places as it designates and in accordance with the provisions of these rules. Examinations shall be held at least annually. Sixty days notice of the examination date shall be given. The board, as a result of the examination and the requirements of the act, shall recommend to the commission the issuance or non-issuance of certificates.

(3) The commission may maintain reciprocal certification with other states.

R 323.26. Qualifications for certification.

Rule 26. (1) The board may recommend for certification, following an oral examination and such other examinations, including an evaluation of the applicant's experience, as the board may require, persons with the following qualifications:

(a) Minimum requirements - all types of classification no. 1:

(i) The ability to read and write.

(ii) Comprehension of the principles and problems of management of the treatment process and facilities.

(iii) The ability to perform arithmetic calculations necessary to operate the waste treatment facility and prepare the required report to the commission.

(b) Minimum requirements - all types of classification no. 2:

(i) The equivalent of a high school education with the equivalent of high school chemistry.

(ii) Comprehension of the principles and problems of management of the treatment process and facilities.

(iii) The ability to perform arithmetic calculations necessary to carry out the operation of the waste treatment facility and prepare the required report to the commission.

(c) Minimum requirements - all types of classification no. 3:

(i) The equivalent of 2 years of college education in engineering, chemistry, biological sciences or allied field. Graduation from high school and with at least 4 courses in post-high school level chemistry or biological sciences or both may be considered to be equivalent.

(ii) Comprehension of the principles and problems of management of the treatment process and facilities.

(2) The board may recommend for certification in an appropriate classification, without written examination, or with oral examinations at the board's option, persons having the following qualifications:

(a) Applicants who are registered professional engineers in Michigan and have at least 2 years experience in the water pollution control or waste treatment field.

(b) Applicants who have a bachelor of science or higher degree in engineering, chemistry, biological sciences, or allied field and have at least 3 years experience in the water pollution control or waste treatment field.

(c) Applicants who hold a classification no. 1 or 2 certificate, have at least 5 years experience in the water pollution control or waste treatment field, have proven their competence in their present classification, and have successfully completed advanced courses in 1 or more of the following: chemistry, biological sciences and waste treatment operation.

(3) Oral examinations, when held by the board, shall determine the overall knowledge of the applicant in regard to the operation of the type of facility the applicant will be responsible for, and the possible effects of discharge of untreated or inadequately treated waste upon the waters receiving the plant effluent.

(4) The commission may deny a certificate to a person who has given false information in his application or who has been guilty of fraudulent practices in his examination. This denial, or any other denial of a certificate, may be appealed from in accordance with the commission's rules of procedure.

R 323.27. Renewal and revocation of certificates.

Rule 27. (1) A certificate is valid for 5 years from the next July 1st after the date of issuance. On or after January 1 of the year in which a certificate expires, the certified person may apply for renewal thereof. The commission may waive re-examination if the certified operator's operation record justifies such exceptions. Failure to apply for renewal shall result in termination of such certification. The commission shall notify the certified operator and the owner as to the action it has taken.

(2) If the certificate of an operator is not renewed within 30 days after its renewal date, the commission shall give notice of the non-renewal to the owner and the operator and 30 days thereafter certification shall be terminated unless application for renewal has been received in the interim.

(3) The commission may revoke the certificate of a person, who after a hearing, is adjudged incompetent or unable to properly perform the duties of operator in his classification, or who has practiced fraud or falsification or who has been negligent in the discharge of his duties. Notice of revocation shall be given to the owner and to the person whose certification is being revoked.

R 323.28. Persons in responsible charge and changes.

Rule 28. (1) An owner shall designate a certified operator to be in responsible charge of the day-to-day operation of each waste treatment facility and shall inform the commission of the designation. The owner may replace the designated operator with another properly certified operator at any time and shall notify the commission within 10 days after the replacement.

(2) A certified operator who changes his address or place of employment shall notify the commission thereof within 30 days after the change.

R 323.29. Reports.

Rule 29. The person in responsible charge of a waste treatment facility shall file with the commission, each month or at such longer interval as the commission may designate, on forms provided by the commission, operating reports showing the effectiveness of the treatment facility operation and the quantity and quality of liquid wastes discharged into the public lake or stream. When the person in responsible charge is not available to file the report, the owner may appoint a substitute suitable to the commission to file the report.

APPENDIX L

Municipal Surface Water Discharges in The Lake Superior Basin

TABLE I

MICHIGAN'S
MUNICIPAL SURFACE WATER DISCHARGES
LAKE SUPERIOR BASIN

				Discharge Characteristics							
Community	Receiving Waters	Treatment Provided	Population (1964 est.)	5-day BOD Influent mg/l	5-day BOD Effluent mg/l	5-day BOD Effluent % Removal	Suspended Solids Influent mg/l	Suspended Solids Effluent mg/l	Suspended Solids Effluent % Removal	Flow MGD	Status and Abatement Action
Discharge Directly to Lake Superior											
Baraga	Lake Superior	Primary ST	980	- - - No Data Available - - -							Preliminary plans for secondary treatment approved 9/15/67. Start construction by 6/1/70, completion by 6/1/71.
Montreal River Basin											
Erwin Twp.	Ground Waters	Secondary SF	100	- - - No Data Available - - -							See note 6B
Ironwood	Montreal River	Secondary AS	10,260	79	8	90	93	4	96	1.54	Preliminary plans received for stormwater separation and phosphate removal 6/9/69.
Ironwood Township	Welch Creek	Secondary TF	420	250	66	74	144	46	69	0.02	Preliminary plans for improved treatment received 5/5/69.
Black River Basin											
Bessemer	Kallander Creek	Secondary TF	3,100	155	22	86	97	10	90	0.47	F.O.D. adopted 12/69 for improved secondary treatment and chlorination. Preliminary plans 6/1/70, start construction 1/1/71, completion 12/1/71.
Ramsay	Black River	None	1,100	- - - No Data Available - - -							F.O.D. adopted 9/69, preliminary plans for secondary treatment approved. Start construction by 8/1/70, completion by 12/1/71.
Wakefield	Planter Creek	Secondary L	3,230	- - - No Data Available - - -							New Plant, Operating satisfactorily
Presque Isle River											
Marenisco	Presque Isle River	None	900	- - - No Data Available - - -							Engineers employed. Conference held September 29, 1966, corrective program underway.
Mineral River Basin											
White Pine	Mineral River	Secondary TF	950	79	17	78	111	17	85	0.32	Current facilities satisfactory.
Ontonagon River Basin											
Bergland	Lake Gogebic	None	600	- - - No Data Available - - -							Preliminary plans for secondary treatment approved 2/30/70
Bruce Crossing	Clear Creek	None	100	- - - No Data Available - - -							Preliminary plans for secondary treatment approved.
Ewen	S. Branch Ontonagon R.	None	500	- - - No Data Available - - -							Preliminary plans received.
Ontonagon	Ontonagon River	Primary	2,350	100	65	35	80	43	47	0.28	Current facilities satisfactory
Rockland	Rockland Creek	None	500	- - - No Data Available - - -							Preliminary plans approved 2/30/70.
Watersmeet	Middle Branch Ontonagon River	Primary IT	500	200	90	55	80	40	50	0.05	Current facilities satisfactory.
Sleeping River Basin											
Mass-Greenland	Flintsteel River	None	500	- - - No Data Available - - -							Preliminary plans received.
Portage Lake Basin											
Baltic	Branch Pilgrim R.	Primary ST	100	- - - No Data Available - - -							See note 6B
Copper City	Trap Rock River	Primary ST	290	- - - No Data Available - - -							See note 6B
Florida	Hammell Creek	Connected to Laurium	400	- - - No Data Available - - -							

Community	Receiving Waters	Treatment Provided	Population (1964 est.)	Discharge Characteristics 5-day BOD Influent mg/l	5-day BOD Effluent mg/l	5-day BOD Effluent % Removal	Suspended Solids Influent mg/l	Suspended Solids Effluent mg/l	Suspended Solids Effluent % Removal	Flow MGD	Status and Abatement Action
Portage Lake Basin (con't)											
Laurium	Hammell Creek	Primary ST	3,000	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Preliminary plans approved 6/28/67. Summary judgement to abate unlawful pollution. Start construction by 7/1/70, completion by 12/1/70.
Painesdale*	Ditches	None	950	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							See note 6B
South Range	Branch Pilgrim R.	Primary ST	750	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							See note 6B
Portage Township	Huron Creek	None	50	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							See note 6B
Carp River Basin											
Ishpeming	Carp River	Primary	8,800	82	33	59	94	30	67	1.58	Current facilities satisfactory
Ishpeming Twp. A	Carp River	Primary IT	1,000	166	103	37	153	68	55	0.09	Current facilities satisfactory
Ishpeming Twp. B	Carp River	Primary IT	400	215	131	38	238	93	60	0.02	Current facilities satisfactory
Marquette	Carp River	Primary	21,200	176	57	68	117	31	72	2.62	Current facilities satisfactory
Negaunee	Ditch	Secondary TF	6,000	105	21	80	97	20	79	0.27	Current facilities satisfactory
Au Train River Basin											
Chatham	Slapneck Creek	None	250	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Engineers employed. Conference held September 30, 1966, corrective program underway
Tahquamenon River Basin											
Newberry	Tahquamenon River	Primary	5,075	167	110	34	171	81	53	0.75	Current facilities satisfactory
Miscellaneous											
Ahmeek	Hills Creek	None	265	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Pre-engineering report for secondary treatment approved.
Allouez	Hills Creek	None	175	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Conference held September 30, 1966, corrective program underway
Big Bay	Lake Independence	Primary ST	225	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							6B
Calumet	Ground waters	Secondary SL	1,140	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Served by Northern Michigan Water Co.
Gay	Tobacco River	Primary ST	240	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							6B
Houghton-Hancock	Portage Lake	Secondary AS	12,420	122	10	92	170	17	90	1.81	Served by Portage Lake Water and Sewage Authority
Hubbell	Torch Lake	None	1,400	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Engineers employed
Lake Linden	Torch Lake	None	1,300	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Engineers employed Conference held September 30, 1966, corrective program underway
L'Anse	Linden Creek	Secondary AS	2,390	111	4	96	116	3	96	0.78	Current facilities satisfactory
Mohawk	Hills Creek	None	585	- - - - - - - - - - - - - - No Data Available - - - - - - - - - - - - - -							Preliminary plans received
Munising	Anna River	Primary	4,100	102	53	48	48	23	52	1.03	Current facilities satisfactory

*Small amount discharged to Otter River - Sturgeon Basin.

NOTE:
A.S. - Activated Sludge
T.F. - Trickling Filter
S.F. - Sand Filter
L. - Lagoons
S.L. - Seepage Lagoons
I.T. - Imhoff Tank
S.T. - Septic Tank
6B - Units have been notified that they are in violation of Section 6B, Act 245; voluntary corrective action being sought.
F.O.D. - Final Order of Determination
O.D. - Order of Determination

APPENDIX M

Communities in the Michigan Portion of the Lake Superior Basin with Combined Sewer Systems

Communities in the Michigan Portion of the Lake Superior Basin With Combined Sewer Systems

Baltic (unincorporated), Houghton County
Bessemer Township, Gogebic County
Bessemer, City of, Gogebic County
* Big Bay, Village of, Marquette County
Hancock, City of, Houghton County
* Houghton, Village of, Houghton County
* Ironwood, City of, Gogebic County
Ishpeming, City of, Marquette County
Laurium, Village of, Houghton County
Marquette, City of, Marquette County
* Munising, City of, Alger County
Negaunee, City of, Marquette County
Ontonagon, Village of, Ontonagon County
Painesdale (unincorporated), Houghton County
South Range, Village of, Houghton County
Wakefield, City of, Gogebic County

* Note: Sewers in portions of the system have been separated.

APPENDIX N

Act 91, Public Acts of 1968 -- Pesticide Use and Sales Regulations

ACT NO. 91
Public Acts of 1968
Approved by Governor
June 4, 1968

STATE OF MICHIGAN
74TH LEGISLATURE
REGULAR SESSION OF 1968

Introduced by Reps. Powell, Traxler, Edson V. Root, Jr., Woodman and Stacey
Rep. Rohlfs named as co-sponsor

ENROLLED HOUSE BILL No. 3683

AN ACT to amend sections 1, 5, 6, 9 and 10 of Act No. 233 of the Public Acts of 1959, entitled as amended "An act to prevent the destruction or damage of agricultural crops, growing plants, livestock or wildlife from the application of any economic poison, pesticide, insecticide, herbicide, fungicide, rodenticide; to provide for the licensing of persons engaged in the business of applying economic poisons out of doors and imposing penalties for violations; to provide for the collection of licensing fees; and to prescribe the powers and duties of certain officers," being sections 286.411, 286.415, 286.416, 286.419 and 286.420 of the Compiled Laws of 1948.

The People of the State of Michigan enact:

Section 1. Sections 1, 5, 6, 9 and 10 of Act No. 233 of the Public Acts of 1959, being sections 286.411, 286.415, 286.416, 286.419 and 286.420 of the Compiled Laws of 1948, are amended to read as follows:

Sec. 1. As used in this act:

(a) "Equipment" means any mechanical device, system, apparatus, or method utilized in the application of economic poisons out of doors.

(b) "Economic poison" means any substance or mixture of substances, by whatever term designated, intended for preventing, destroying, repelling or mitigating any insects, rodents, nematodes, fungi, weeds and other forms of plant or animal life or viruses, except viruses on or in living man or other vertebrate animals, and any substance or mixture of substances intended for use as a plant regulator, defoliant or desiccant, and any other substance intended for such use as may be named by the director of agriculture by rule.

(c) "Insecticide" means a substance or mixture of substances intended for preventing, destroying, repelling or mitigating insects.

(d) "Fungicide" means a substance or mixture of substances intended for preventing, destroying, repelling or mitigating fungi.

(e) "Herbicide" means a substance or mixture of substances intended for preventing, destroying, repelling or mitigating weeds.

(f) "Defoliant" means a substance or mixture of substances intended to cause the leaves or foliage to drop from a plant, with or without causing abscission.

(g) "Desiccant" means a substance or mixture of substances intended for artificially accelerating the drying of plant tissue.

(h) "Plant regulator" means a substance or mixture of substances intended through physiological action, for accelerating or retarding the rate of growth or rate of maturation or for otherwise altering the behavior of plants, but does not include substances to the extent that they are intended as plant nutrients, trace elements, nutritional chemicals, plant inoculants and soil amendments.

(i) "Nematocide" means a substance or mixture of substances intended for preventing, destroying, repelling or mitigating nematodes.

(j) "Insect" means a small invertebrate animal generally having a body more or less obviously segmented, for the most part belonging to the class insecta, comprising 6-legged, usually winged forms, as, for example, beetles, bugs, wasps and flies, and to other allied classes of arthropods whose members are wingless and usually have more than 6 legs, as, for example, spiders, mites, ticks, centipedes and wood lice.

(k) "Fungi" means nonchlorophyll-bearing thallophytes of a lower order than mosses and liverworts as, for example, rusts, smuts, mildews, molds, yeasts and bacteria, except those on or in living man or other animals.

(l) "Weed" means a plant or part thereof which grows where not wanted.

(m) "Nematode" means an invertebrate animal of the phylum nemathelminthes and class nematoda.

(n) "Person" means any individual, firm, partnership, association, corporation, company, joint stock association, or body politic, or any organized group of persons whether incorporated or not; and includes any trustee, receiver, assignee, or other similar representative thereof.

(o) "Aircraft" means a contrivance now known or hereafter invented, used or designed for navigation of, or flight in, the air.

(p) "Ground equipment" means a machine or device other than aircraft, for use on land or water, designed for, or adaptable to, use in applying economic poisons, as sprays, dusts, aerosols, fogs or other forms.

(q) "Director" means the director of agriculture.

Sec. 5. If the director shall find from examination of the application that the applicant is qualified for a license he shall issue such license. The license may restrict the applicant to use of a certain type of equipment or pesticides if the director finds that the applicant is qualified to use only such type. If the license application discloses unsatisfied judgments against the applicant, the director may require a sufficient bond of the applicant conditioned upon the payment of further judgments against him, or the director may refuse to issue a license or annual renewal thereof because of such unsatisfied judgments. The director may refuse to issue a license or annual renewal thereof if the equipment to be used by the licensee is unsafe or inadequate to accomplish the proper application of the economic poisons to be used. The director may refuse to issue a license if the applicant discloses an insufficient knowledge of any item called for in the application. Denial of a license shall be treated as a contested case under the provisions of Act No. 197 of the Public Acts of 1952, as amended, being sections 24.101 to 24.110 of the Compiled Laws of 1948.

Sec. 6. The director may promulgate rules pursuant to the provisions of Act No. 88 of the Public Acts of 1943, as amended, being sections 24.71 to 24.80 of the Compiled Laws of 1948, defining safe and adequate equipment for the application of the several economic poisons; defining wind and weather conditions when certain economic poisons shall not be applied; defining the types of equipment or economic poisons that licensees may use; and defining the method of handling certain economic poisons for the safety of the operator.

Sec. 9. There is created an advisory committee on economic poisons to consult with and aid the director in the administration of this act. The committee shall be composed of the director of conservation, the director of public health, the director of aeronautics, the director of the pesticide research center of Michigan State University and the executive secretary of the water resources commission. Members of the committee may designate an employee to represent them on the committee.

Sec. 10. Any person subject to license under this act who applies economic poisons without such license or who violates an order issued, under this act, is guilty of a misdemeanor.

Clerk of the House of Representatives.

Secretary of the Senate.

Approved

Governor.

APPENDIX O

Handbook of Specifications for the Protection of Natural Resources

INTRODUCTION

Under the authority vested in the Department of Natural Resources to protect and conserve the natural resources of the state (Act 17, P.A. 1921; Act 291, P.A. 1965; and Act 245, P.A. 1929, as amended by Act 167, P.A. 1968), the general objective is to insure good construction practices in all construction work to the end that watercourses are protected from siltation and unreasonable obstruction to flow. As a general guide to implementation of these objectives, the Department is interested in all construction affecting public waters.

BRIDGE CONSTRUCTION OPERATIONS AND SPECIFICATIONS FOR PROTECTION OF NATURAL RESOURCES

BRIDGE-HYDRAULIC DESIGN PROCEDURES - Early in preliminary design considerations, notice should be given to the Hydrological Survey Division, Department of Natural Resources, of an owner's intent to construct or replace a bridge or culvert. Upon receipt of this notice the Hydrological Survey Division will determine and furnish the Intermediate Regional Flood discharge (Q) in cubic feet per second (cfs) for the watercourse at the proposed crossing.

Utilizing the Intermediate Regional Flood discharge (Q), backwater computations should be performed by the design engineer to determine the effect of the proposed structure and approaches on the flood profile and the hydraulic characteristics of the watercourse. These computations should begin a reasonable distance downstream (500 to 600 feet) and be carried through the proposed structure to determine head loss and continued a reasonable distance upstream to permit an evaluation of the effect of the proposed structure on Intermediate Regional Flood stages. The computations should utilize valley cross-sections and channel bottom profile data obtained in the field by the design engineers staff. Any bridge or culvert constructed or reconstructed shall be capable of passing the Intermediate Regional Flood without causing an unnaturally high stage or unnatural direction of flow which may cause damage to property or threat to life.

BRIDGE APPLICATION PROCEDURES - Plans and specifications describing the proposed project should accompany the permit application form and be submitted to the Hydrological Survey Division, Department of Natural Resources, as soon as approved by the owner and at least 60 days prior to taking bids or initiating any work. Bridge and culvert projects designed at FAS projects, shall be submitted to the Local Government Division, Michigan Department of State Highways, for forwarding to the Department of Natural Resources (all other plans and specifications for bridge and culvert projects shall be submitted directly to the Department of Natural Resources). Five (5) copies of the plans and specifications should accompany the application form. Upon completion of a Departmental review, the necessary permits will be issued under Act 291, Public Acts of 1965, and Act 167, Public Acts of 1968.

The following construction items will require submission of plans and specifications:

1. Programmed culvert replacements.
2. Culverts replacing bridges.
3. Bridges.
4. Road improvement projects involving public waters.
5. Structures affecting navigation.
6. Monthly report of culvert replacements not included in the culvert replacement programs.

Bridge and culvert designs meeting the requirements of Administrative Rule 323.202 will require a permit under Act 291, Public Acts of 1965, only. (Copy of Administrative Rules 323.201 to 323.205 is included in the handbook.)

EMERGENCIES - Culvert and bridge repairs and/or replacement may be made in an emergency situation upon contacting the Division for verbal approval. The monthly culvert report should include details of emergency bridge and culvert repairs.

CONSTRUCTION OPERATIONS - Each construction operation should be completed so as to prevent erosion and subsequent damaging siltation of streams or lakes. The area of erodible land exposed to the elements by the grading operations at any one time shall be controlled by the owner's engineer and the duration of such exposure prior to final trimming, finishing and/or maintenance of the area should be as short as practical.

Gravel or stone, consisting of durable particles of rock and containing only negligible quantities of fines, should be used for construction pads, haul roads and temporary roads in or across streams.

When required by the Department of Natural Resources, a sedimentation basin will be constructed downstream from the work site to trap silt and sediment resulting from construction operations. See detail sketch of sedimentation basin. The collected silt and sediment shall be removed as directed by the owner's engineer and the sedimentation basin removed on completion of the project. As found necessary, the Hydrological Survey Division will assist the owner in the design of sedimentation basins.

The disturbance of lands and waters that are outside the limits of construction as staked should be avoided, except as found necessary and approved by the owner's engineer. The work should be conducted in such manner as to prevent the entry of fuel, oils, bituminous materials, chemicals, sewage or other harmful materials into streams, rivers, lakes or reservoirs.

The owner shall give written notice five days prior to the start of work.

SPECIFICATIONS - The Highway specifications listed below are desirable and necessary for the protection of the natural resources. The Hydrological Survey Division will answer all questions and will act as liaison between the Department of Natural Resources and the various owners and/or their engineering consultant.

A new specification was recently reviewed with Michigan Department of State Highways and will be listed in the new 1969 Specifications Handbook as follows:

2.08.41 - Control of Water Pollution and Siltation

DESCRIPTION:

The Contractor shall conduct his work in a manner that will not cause excessive erosion and resultant damaging siltation or pollution of the water in streams, rivers, lakes and reservoirs. The Hydrological Survey Division, Department of Natural Resources will advise the appropriate Regional office of the start of work. All work involving the waters of the state is subject to inspection and control by the Department of Natural Resources.

The Michigan State Highway Design office has information for the design engineer on control of erosion through sodding; water control by catch basins, downspouts, concrete shoulders and spillways; borrow restoration, particularly adjacent to highway limits; seeding, mulching and plantings. Standard plans are available as follows:

STANDARD PLANS:

1. Special Outlet Headwalls, etc.	E-4-A-9F
2. Sodding, etc.	E-4-A-10D
3. Paved ditches, etc.	E-4-A-110C
4. Shoulder gutter and spillway	E-4-A-128

All construction projects should include as a part of the specifications the items listed below as published in the latest edition of the Michigan Department of State Highways Specifications:

A. SPECIFICATIONS COVERING MEASURES FOR PREVENTION OF EROSION AND SILTATION

1.	Topsoil Surface	Sec. 6.23 Std. Specs.
2.	Mulching	Sec. 6.24 Std. Specs.
3.	Seeding	Sec. 6.22 Std. Specs.
4.	Fertilizing	Sec. 6.22 Std. Specs.
5.	Riprap (plain - heavy)	Sec. 6.05 Std. Specs.
6.	Cobble Gutter (plain - grouted)	Sec. 6.12 Std. Specs.
7.	Slope Planting	Sec. 6.25 Std. Specs.
8.	Dune Grass Planting	Sec. 6.26 Std. Specs.
9.	Sodding	Sec. 6.21 Std. Specs.
10.	Slope Protection	Sec. 6.41 Std. Specs.
11.	Crushed Limestone Surface	Supp. Spec.
12.	Paved Ditches	Supp. Spec.
13.	Rye Seeding	Sec. 6.22 & Supp. Specs.

B. GENERAL COVERAGE IN PROPOSAL OR SPECIFICATIONS

1.	Protection and Restoration of Property	Sec. 1.07.07 Std. Specs.
2.	Forest Protection	Sec. 1.07.13 Std. Specs.
3.	Borrow Areas	Sec. 2.08.10 Std. Specs.
4.	Borrow Area Restoration	Supp. Spec.
5.	Channel Excavation	Sec. 2.09.05 Std. Specs.
6.	Control of Water Pollution & Siltation	Sec. 2.08.41 Std. Specs.

Copies of these specifications will be made available to all railroad design engineers through the Department on request.

SPECIFICATIONS FOR PROTECTION OF NATURAL RESOURCES AT UTILITY WATER CROSSING

APPLICATION PROCEDURES AND SPECIFICATIONS - Plans for all underground utility projects where construction is contemplated to cross or be within 50 feet of a stream, lake or reservoir shall be furnished by the utility owner (hereinafter referred to as the "Company") to the Hydrological Survey Division of the Bureau of Water Management, Department of Natural Resources (hereinafter referred to as the "Division").

The Division will review the general plans submitted and will determine the adequacy of the measures specified to minimize erosion and siltation. Meetings with the Company to discuss measures desired by the Division will be scheduled if required. Upon acceptance by the Company of the plans modified or augmented by any measures as may be prescribed by the Division, a permit will be issued to the Company. Where possible, said permit shall be issued prior to solicitation of bids. In any case, the objective of the Division will be to make its requirements known with certainty prior to taking of bids to enable the Company and its contractors to conduct their construction operations in a manner to carry out the conservation objectives of the Division with a minimum of confusion and at reasonable cost.

Non-compliance with the terms of the permit shall be cause for revocation of the permit.

1. General Requirements - All Size Pipelines and Conduits

a. The Company will submit general construction plans, including a route map and stream crossing specifications for transmission and major distribution lines. These general plans and related documents will be submitted not later than three months prior to the solicitation of bids and preferably the route plans should be reviewed with the Department prior to acquisition of rights-of-way.

The Company shall submit plans for small distribution lines, service lines and gathering lines with the application for crossing permits at least three weeks in advance of construction. The Department may decrease or waive the above notice requirements for particular projects on a suitable showing by the Company of hardship or emergency.

Lines in these specifications include, but are not limited to, gas pipelines, oil or petroleum products pipelines, underground structures or communication cables and water and sewer lines.

b. A pre-construction meeting will be held if deemed necessary by either the Division or the Company in order to thoroughly acquaint all concerned parties with the measures which must be taken to minimize erosion and siltation and properly protect the natural resources in the project area.

c. Ten (10) days written notice shall be given to the Division by the Company before the beginning of work.

d. The Company shall take all necessary steps to prevent damage to fish and game habitat, and to preserve the natural resources of the state. Excavation shall be carried out so as to minimize discharge of damaging material into any stream, lake or reservoir.

e. The work of clearing, scalping, grading, slope erosion protection, ditching, backfilling and final clean-up within 50 feet of streams, lakes, and reservoirs shall be completed within as short a period as reasonably possible in order to minimize erosion occurring from wind and precipitation.

f. Trench excavation on any one spread shall be stopped when 10,000 feet remain open, except as authorized in the permit issued by the Department.

g. Replacing of bank plugs and grading of stream banks within fifty feet shall be accomplsihed immediately following pipe laying.

2. Special Requirements

Certain information and special protective measures may be required by the Division at specified water crossings. The following items, if required, will be outlined by the Division to the Company either prior to or in the permit issued covering the job.

a. Three (3) days oral notice of crossing, ditching or blasting within 50 feet of certain water crossings.

b. Construction work across certain water crossings may be prohibited within three (3) days just preceding, or during, Memorial Day, Independence Day or Labor Day holiday periods.

c. Installation of approved warning signs may be required at certain water crossings, to be located as directed by the Division, to provide notice of pipeline crossing construction or excavation and shall be maintained by the Company until removal is authorized by the Division or until the water crossing bed has been restored to normal.

d. Soil data on certain water crossings may be requested to determine the nature of soil to be encountered; to delineate possible trouble areas with regard to trench excavation limits. A plan and profile sheet of the water crossing may be requested by the Division where soil data indicates a need therefor.

e. Temporary sedimentation basins or cofferdams may be required for certain water crossings. In such case, the provisions for sedimentation basins hereinafter set forth shall apply.

3. SEDIMENTATION BASINS AND COFFERDAMS

a. Sedimentation basins or cofferdams, where required, shall be constructed prior to any other work at the site crossing. (See page 9.)

b. Temporary weirs or cofferdams are to be removed, including any materials trapped by them in the control of siltation, within two weeks of final clean-up. Intermittent removal of silt or sand during construction may be required for proper operation of sedimentation basins. In any event, the sedimentation basins shall be cleaned before removal.

c. Weirs shall be constructed of continuous interlocking steel sheeting except where other substitute materials are authorized by the Department. When specified by the Department, a detail sheet of the weir installation will be furnished by the owner.

d. It shall be the Company's responsibility to secure the necessary approval of private land owners where temporary additional right-of-way or easement are necessary to construct and operate a settling basin. No easement will be required in locations where the crossing is made on state-owned lands.

4. Haul Roads

a. Temporary haul roads crossing streams shall be constructed of coarse aggregate with culverts and/or logs laid parallel to the stream. Only coarse aggregate or metal or wood mats may be used as a running surface on log construction. The side slopes shall be protected with permanent riprap, as specified in paragraph 5 below, up to a level two rows above the normal water level and over the ends of the culverts.

b. Permanent haul roads crossing streams (roads that are to be left in place at the request of the property owner) will require a permit under Act 167, Public Acts of 1968. Plans and specifications for such crossings must be prepared by a registered professional engineer and must be submitted by the property owner along with his application for a permit to construct such facilities.

c. Both temporary and permanent haul roads shall have adequate top width to permit passage of all construction equipment without sloughing of side slopes.

d. Culverts of adequate size and length, approved by the Division, will be required in both temporary and permanent haul roads.

e. Fording of streams will be permitted only where erosion and/or siltation will not be caused by this action.

5. Trench Excavation

a. All pipe trenches shall be excavated to a depth which will provide a minimum cover of 30 inches from bed of stream to top of pipe. This minimum cover shall control except in those cases where special conditions at certain water crossings may warrant a lesser or greater depth of cover.

b. Appropriate trench excavation methods shall be employed to minimize material from the pipe trench flowing into the stream, giving due consideration to the soil, terrain, cover, side slopes and weather conditions involved.

c. The pipe trench excavation shall stop some distance from the stream to leave a protective plug of 10 to 20 feet of unexcavated material at each bank. These plugs shall be left in place until the pipe laying operation across the stream has begun. Bypassing of water in the trench to the side by diversion ditches or by pumping may be required at certain water crossings.

d. The trench in the stream bed may be backfilled, providing the material used does not cause excessive siltation. Stone, coarse aggregate or washed gravel should be used where backfill is required and where use of existing material will cause excessive siltation.

e. Pumping or draining from trench excavations shall be made on either side of the pipeline and not into the waters of the state. It shall be the Company's responsibility to secure the necessary approval of private land owners before discharging water from the trench excavation onto private lands.

6. Stream Bank Protection

a. Following the installation of the pipeline or cable, all work areas along or across streams or lakes shall be restored immediately in accordance with the procedures outlined below, and in no event shall the exposed bed and banks remain unprotected over seven days, except where subsequent permission is provided for a "pumping and testing operation".

b. All disturbed stream banks shall have a finished slope no steeper than one on two (one vertical and two horizontal) to prevent sloughing until stabilized by vegetative cover or riprap. The one-on-two slope shall be graded up and back to the high water line. If the top of the natural bank is more than three feet above the high water line, a minimum 10-foot berm shall be constructed at this level and the remaining slope constructed upward parallel with or on a flatter slope than the original natural bank. (See page 13.)

c. All raw soil exposed above the permanent riprap protection line shall be either sodded; riprapped; or seeded, fertilized and mulched. Temporary riprap (sand bags) may be used.

d. Mulch is to consist of three inches of straw or other approved material. Mulch on slopes greater than 10 percent shall be held in place by a spray of asphalt type SS-1S emulsion mixed with an equal amount of water.

e. Seeding and fertilizing rates shall be as follows: Fertilizer per acre - 200 pounds of 6-24-24; Seed per acre - 10 pounds Kentucky 31 fescue, 3 pounds Birdsfoot trefoil, and 3 pounds white clover.

f. Permanent riprap shall be placed three feet above normal high water line or to top of the bank. Permanent riprap shall be 5 to 1 mix of sand to cement in burlap or canvas bags, "Sackrete", broken concrete, man-size rock or other material approved by the Division. "Sackrete" where used shall be transferred to burlap or canvas bags.

g. Deflection dikes, reinforced by one row of sandbags, shall be used to divert runoff and minimize slope erosion from steep slopes adjacent to water crossings, where the contributing runoff could be great enough to cause slope erosion. Water shall be diverted to undistrubed areas adjacent to the right-of-way.

h. Deflection dikes shall be placed along the top of all stream banks where the entire slope is not protected with riprap. They shall also be placed at the top of and at 100 foot intervals or less on slopes greater than 20%.

7. Final Clean-up

Final clean-up shall consist of removing the temporary haul road across the stream; reshaping the stream as nearly as possible to its original configuration, width, depth and bottom material; protection of the streambanks as specified in paragraph 6 above; and removing all construction material and debris from the crossing site, including any material and debris deposited downstream from the site as a result of the pipeline construction.

8. Use of Water for Cleaning and Testing Pipeline

The cleaning and testing procedure will be conducted in a manner that will minimize potential problems which might affect fish and game habitat or other natural resources of the state.

Water used for filling the pipeline may be taken from a lake, stream or reservoir, providing a written request is made to the Division, and if the requisites listed below are met. In addition, location of points for discharge of cleaning and testing water must be approved in advance by the Department (New Use Statement application).

a. Erosion or siltation are to be minimized.

b. Appropriate releases from the affected riparians shall be obtained where the rate at which water is taken to fill pipe is more than 30% of the flow at the time, or if a state-owned lake or reservoir is exhausted beyond 15% of the total volume.

c. Water containing detergent or rust from the pipe itself shall be discharged so as to prevent its flowing into any stream, lake or reservoir except where a special request for this specific procedure is made.

d. Water used for hydrostatic testing shall be discharged in a manner and at a location which will minimize erosion or siltation to any stream or public reservoir, and which will not result in thermal pollution of any trout waters.

e. The rights of any and all downstream riparians shall be recognized and observed regardless of approval of a "no objection" statement from the Division.

f. Only those chemicals shall be used (detergent mix) which are approved by the Division.

APPENDIX P

Construction Grant Program Status of Grant Offers and Developments Since the March Meeting

CONSTRUCTION GRANT PROGRAM

STATUS OF GRANT OFFERS
&
DEVELOPMENTS SINCE MARCH MEETING

I SEWAGE TREATMENT WORKS

A. Status Of Projects From June 27, 1968 Priority List

1. Since the March Meeting grant offers have been made as follows:

MONROE COUNTY (South Rockwood)	$ 16,095.00
KALAMAZOO COUNTY (Portage)	2,219,001.00
GRAND RAPIDS	399,344.00
	$ 2,634,440.00

2. To date, offers of State Grants and Advances totalling $62,477,939.00 have been made for 51 projects.

B. Projects Eligible For Additional Grant Funds (Construction commenced after June 30, 1967)

1. No change since March Meeting (30 projects - $12,649,344.00)

C. To Date, Commitments Totalling $75.12+ Million Have Been Made From The Water Pollution Control Fund.

D. Grant Payments

1. Since the March Meeting grant payments have been made to the following communities in the amounts indicated:

KALKASKA	$ 36,439.00
CRYSTAL FALLS	142,358.00
BIG RAPIDS	145,623.00
POTTERVILLE	45,587.00
	$ 370,007.00

2. To date, grant payments totalling $4,648,029 have been made for 9 projects.

II COLLECTING SEWERS

A. Status Of Calendar Year 1969 Projects

1. Since the March Meeting grant offers totalling $355,255.00 have been made as follows:

VAN BUREN COUNTY (Decatur)	$ 305,835.00
ROSE CITY	49,420.00
	$ 355,255.00

2. To date, grant offers totalling $4,633,554.00 have been made for 20 projects.

III FISCAL YEAR 1970 PROGRAM

A. Certification of projects to the Federal Water Pollution Control Administration Regional Office is expected to begin during the week of April 13. Preparatory thereto, staff has:

1. Notified all applicants to revise their requests for Federal grants to 5% of the eligible project cost.
2. Obtained state clearinghouse (planning agency) approval of all projects

approved by the legislature. (This is a new procedure required by U. S. Bureau of the Budget Circular A-95.)

3. Prepared an amendment to the State Water Pollution Control Plan consisting of a priority list of municipal projects eligible for Federal grant assistance for the current plan year. This list supplements the preliminary list submitted in August 1969. Submission of the list is a prerequisite to certification of projects.

ANC
4/10/70

APPENDIX Q

Water Use Designation for Upper Peninsula Waters Previously Exempted

WATER USE DESIGNATION AREAS FOR MICHIGAN'S INTRASTATE WATER QUALITY STANDARDS FOR UPPER PENINSULA WATERS PREVIOUSLY EXEMPTED.

ADOPTED BY MICHIGAN WATER RESOURCES COMMISSION
November 19, 1969

Pending the Attorney General's Opinion on the authority of the Water Resources Commission to regulate the discharge of mining wastes under Section 12 of Act 245, Public Acts of 1929, as amended, certain waters of the State were temporarily exempted from use designations to be protected by intrastate water quality standards. The Attorney General's Opinion, Number 4590, was issued January 27, 1969. In accordance with that opinion the Michigan Water Resources Commission held a public hearing on proposed water use designations for those waters on August 20, 1969. Following are recommendations resulting from the public hearing and the previous staff recommendations to the Commission.

Water uses to be protected by water quality standards are for the following waters:

Black River (Marquette County) - from Humboldt Mine to confluence with the Middle Branch of the Escanaba River
Goose Lake (Marquette County T47N, R26W, Sec. 14) - entire lake
Green Creek (Marquette County) - entire stream
Hammell Creek (Houghton County) - entire stream
Hill Creek (Houghton and Keweenaw counties) - entire stream
Mineral River (Ontonagon County) - from confluence with Native Creek to the mouth
Native Creek (Ontonagon County) - entire stream
Partridge Creek (Marquette County) - entire stream
East Sleeping River (Ontonagon County) - that portion of the stream in Ontonagon County
Torch Lake (Houghton County) - entire lake
Trap Rock River (Houghton and Keweenaw counties) - entire stream

RECOMMENDED USE DESIGNATIONS

A. WATER SUPPLY

(1) There are no existing public water supply intakes from these waters in use so the Domestic Water Supply designation is not applicable.

(2) All public waters will be protected for Industrial Water Supply.

B. RECREATION

(1) All public waters will be protected for Total Body Contact except for bacterial clearance zones below the following sewered communities:

Hammell Creek - downstream from the Laurium discharge
Trap Rock River - downstream from the Copper City discharge
Hill Creek - downstream from Mohawk
Hill Creek - downstream from Ahmeek

(2) All public waters will be protected for Partial Body Contact.

C. FISH, WILDLIFE AND OTHER AQUATIC LIFE

The following waters under consideration will be protected for Intolerant Fish, cold-water species:

Black River
East Sleeping River
Green Creek
Hill Creek
Trap Rock River

All public waters will be protected for Intolerant Fish, warm-water species.

All streams tributary to the Great Lakes will be protected for anadromous fish migration.

D. AGRICULTURAL

All public waters will be protected for Agricultural use.

IN ADDITION: It has been and continues to be the policy of the Water Resources Commission to abate existing pollution and prevent the occurrence of future pollution of all waters of the State.

It is intended that the water quality for a designated use be maintained except in those instances where because of natural conditions the quality is lowered.

Where the aforementioned waters are classified under more than one designated water use, it is intended that the most restrictive individual standards of the designated water uses shall be adhered to.

The use designations adopted by the Commission are in all cases minimal and are not to be interpreted as a license to cause injuries declared to be unlawful by Act 245, P.A. 1929, as amended, or to do any other unlawful act.

COMMISSION OBJECTIVE:

Water in which the existing quality is better than the established standards on the date when such standards become effective will not be lowered in quality by action of the Water Resources Commission unless and until it has been affirmatively demonstrated to the Michigan Water Resources Commission that the change in quality will not become injurious to the public health, safety, or welfare, or become injurious to domestic, commercial, industrial, agricultural, recreational or other uses which are being made of such waters, or become injurious to the value or utility of riparian lands; or become injurious to livestock, wild animals, birds, fish, aquatic life or plants, or the growth or propagation thereof be prevented or injuriously affected; or whereby the value of fish and game may be destroyed or impaired, and that such lowering in quality will not be unreasonable and against public interest in view of the existing conditions in any intrastate waters of Michigan.

Water which does not meet the standards will be improved to meet the standards.

ADDENDUM TO MICHIGAN'S REPORT
FOR RECONVENED CONFERENCE
LAKE SUPERIOR

April 1970

Waste dischargers within the State of Michigan which affect Lake Superior water quality are listed below with treatment needs and implementation actions initiated to date.

Community	Treatment Needs	Status
Village of Baraga	Sec. and P removal	Stipulation with WRC; Abatement date 6/1/71.
City of Ironwood	P removal	Notified of need 4/7/70; Action pending*.
City of Bessemer	Improve Sec.; Chlorination and P removal	Final Order of Determination; Abatement date 12/1/71.
Township of Bessemer, Gogebic County (Ramsay)	Sec. and P removal	Final Order of Determination; Abatement date 12/1/71.
White Pine (White Pine Copper Company)	P removal	Notified of need 4/7/70; Action pending*.
Village of Ontonagon	Sec. and P removal	Notified of need 4/7/70; Action pending*.
Village of Laurium	Sec. and P removal (land disposal proposed)	Circuit Court Order.
City of Ishpeming	P removal	Notified of need 4/7/70; Action pending*.
Township of Ishpeming, Marquette County	P removal	Notified of need 4/7/70; Action pending*.
City of Marquette	Sec. and P removal	Notified of need 4/7/70; Action pending*.
City of Negaunee	P removal	Notified of need 4/7/70; Action pending*.
Village of Newberry	P removal	Notified of need 4/7/70; Action pending*.
Village of Houghton	P removal	Notified of need 4/7/70; Action pending*.
City of Hancock	P removal	Notified of need 4/7/70; Action pending*.
Village of L'Anse	P removal	Notified of need 4/7/70; Action pending*.
City of Munising	Sec. and P removal	Notified of need 4/7/70; Action pending*.

Industry	Treatment Needs	Status
Hoerner-Waldorf, Inc., Ontonagon Mill Division	Secondary	Notified of need 4/27/70; Action pending*.

*Where abatement actions are pending, the WRC will either enter into Stipulations with the waste discharger or initiate statutory proceedings leading to a Final Order of Determination. The Stipulations and Orders will contain a performance time schedule for accomplishing secondary biological treatment where applicable ard 80% phosphorus removal by not later than January 1974, or if only phosphorus removal is required, by not later than January 1975. A typical schedule will call for the following:

1.	Retain engineers.	December 1, 1970
2.	Submit preliminary engineering report	September 1, 1971
3.	Initiate detailed engineering plans and specifications. .	November 1, 1971
4.	Submit detailed engineering plans and specifications. . .	June 1, 1972
5.	Arrange financing	September 1, 1972
6.	Initiate construction	October 1, 1972
7	Complete construction and place in operation.	January 1, 1974

MR. STEIN: Thank you.

Are there any comments or questions?

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: May I ask Mr. Purdy or the speaker--I am sorry, I didn't get your name.

MR. STEIN: Would you repeat your name, sir?

MR. COURCHAINE: Courchaine.

MR. BADALICH: Mr. Courchaine. On Appendix L you have a listing of all the municipalities that contribute to the Lake Superior Basin, and on the column on the far right indicating the status and abatement action, will all of these communities provide secondary treatment by the conference completion dates? You have some noted here as primary treatment being satisfactory and nothing else being shown for abatement.

MR. COURCHAINE: All of those that do affect the interstate waters will be required to provide secondary treatment.

MR. BADALICH: All right.

MR. STEIN: Are there any other questions or comments?

MR. MAYO: I have got a couple of questions.

With respect to the city of Bessemer, I gather from this addendum that the final date for the provision of chlorination would be extended to December 1, 1971, as compared to the May 1970 deadline provided for in Recommendation 6 of the earlier conference session.

So I--is--

MR. PURDY: This is correct, Mr. Mayo. The Bessemer treatment facility is totally inadequate. There is no way that chlorination facilities can be added and be effective with the present facility. It takes a replacement of the total plant. The Commission held a hearing on it, adopted an order that would require the new facility.

MR. MAYO: So that at least that point of extension I think is properly before the conferees today?

MR. PURDY: That is correct.

MR. MAYO: I have a question on the Michigan boating law as well.

Does Michigan feel that this can be applied to the federally-documented vessels, or, again, do you feel you are constrained in terms of those vessels that are involved in interstate commerce?

MR. PURDY: The vessels that are involved in interstate commerce are exempted from it.

MR. MAYO: In Michigan would the local harbor authorities or the county in which a harbor is located or the municipality in which a harbor is located have the authority to prevent the discharge of sewage wastes within the harbor?

MR. PURDY: They have the authority to adopt such ordinances if they so wish.

MR. MAYO: Are these kind of ordinances presently in effect in any of the principal harbors in Michigan?

MR. PURDY: They are not generally in effect. I wouldn't say that none have such ordinances, but most do not.

MR. MAYO: Well, I think, Mr. Chairman, we may be at a point here where it will be well for the conferees to seriously consider any collective limitations that the State boating laws have on commercial traffic in Lake

Superior. If they find that collectively the statutes are inoperative with regard to commercial vessels, then it would be extremely desirable for the States to work with the cities or the harbor authorities to develop some uniform ordinances and to press for the adoption of those ordinances so that clearly, at least so far as the harbor areas are concerned, we can eliminate the discharge of either untreated or inadequately treated vessel wastes.

MR. PURDY: Mr. Chairman, I don't object to the thought. I hope, though, that you can recognize the problems involved in this now since the Federal legislation has been adopted and it provides certain compliance time.

I do recognize that the Federal legislation provides that the State can act in the interim period. But we just completed a court case on our present regulations, and part of it involved the desire of the boating community to delay enforcement of our regulations until the Federal regulations are in effect.

Our Commission did not agree with it. They stated they will enforce the regulations. The court upheld the position of the Commission. But this is a difficult area at the present time.

MR. MAYO: I think, though, that we had an expression yesterday from one of the AFL-CIO representatives speaking for the longshoremen here in Duluth saying that the longshoremen apparently would refuse to work on vessels that did not have a proper certification with regard to the discharge of ballast. Well, if the harbor authorities and the municipalities have the authority to control these discharges, at least so far as the harbor areas are concerned, it is kind of a back door approach to be looking for leadership from the labor group to take on the achievement of those controls when we have other devices--

MR. PURDY: Well, I haven't--

MR. MAYO: --available to impose them.

MR. PURDY: I haven't expressed opposition to your views. I am just saying it is an extremely difficult area. It is not going to be easy. Nothing else is easy either.

MR. STEIN: That is right.

Are there any other comments?

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: Speaking to Mr. Mayo, what is the leadership that the Federal Government is going to provide now on boat heads as far as the Water Quality Improvement Act of 1970? How will this tie in with our State program?

MR. MAYO: Well, the new legislation sets up the timetable for the development of the regulations.

I wasn't here a little earlier. Did you have the presentation?

MR. STEIN: Yes.

MR. MAYO: All right. There will be an interim period while the Federal regulations are being developed, and there are some interim dates established in that legislation, during which the State acts would be operable to the extent that they have jurisdiction.

Now, my point is that even for this interim period, if it is going to be a matter of two or three years, if the States cannot effectively handle the question of discharge of wastes from commercial vessels, and we have an opportunity to control those discharges within the individual harbors by the adoption of effective ordinances by the harbor authorities or the local municipalities or the counties, then we ought to take advantage of that opportunity for the interim period.

MR. BADALICH: Mr. Mayo, that is well and good, but what is the deadline for the Federal legislation? I understand 1976; that is six years from now. In the State of Minnesota we are bound by statutes and actually our law indicates that the federally-documented and licensed craft are exempted. I think we would be pretty hard pressed to have our State Legislature some way or other bind the Federal crafts while actually the Federal Government having a comparable type of a regulation or a statute.

MR. MAYO: Well, I am not suggesting that the States try to bind anybody. All I am suggesting is that if in the individual States within the conference area the harbor authorities and the local municipalities have the authority to prevent these discharges within the harbors, then let's use that authority.

MR. BADALICH: We can with Minnesota licensed boats, but we cannot touch the federally licensed or documented. That is where the problem is in the State of Minnesota, Mr. Mayo.

MR. MAYO: Well, if the city of Chicago--maybe this doesn't apply in Minnesota--if the city of Chicago can prevent the discharge of vessel wastes from any vessel, federally licensed or foreign, within the Port of Chicago, then I think you can do it in any port in the United States on the basis of local ordinance.

MR. BADALICH: Well, I hope so, but I have my doubt on that, sir.

MR. STEIN: Well, here, I was letting this run its course. You know, I think we have some problems here. One of the basic problems that the States have is one of regulation. I am very sympathetic with Mr. Badalich, Mr. Purdy and Mr. Frangos, too, knowing what they are faced with on this boat regulation. We asked about the date--why we have such a late date--and the Federal law being operative, it is the same kind of thing. You get opposition to this, and we are bound by law, as well as the States.

But we have the peculiar phenomenon through the years of having outdoor people and boat owners crying for cleaner water, and the first thing that happened when someone wanted to regulate the pollution from their boats, they said, "You are pushing too fast; you are being unreasonable; we need a delay." From where I sit, they sounded very much like any other polluter, whether they be a city or an industry. And these are the people who are asking for clean water because they use water for recreation. This is the problem the States face.

Now, I do recognize the problem, Mr.Badalich in particular and the other States too. I am not sure that you can regulate foreign vessels by State law in putting in facilities. I am not sure you can regulate United States operated vessels plying in interstate commerce. And that is probably the reason for the Federal law.

However, I think Mr. Mayo does present a point. While you cannot regulate them as far as the type of facilities they would have to have onboard, if such vessels use your harbor you can certainly regulate, it seems to me, the kind of wastes that they would be dumping into that harbor while they are berthed in the harbor. And I don't view this just as an interim measure, because I think a key point in this whole operation of controlling pollution from vessels is not only going to be a requirement that we put on adequate facilities for collecting and treating these wastes on board vessels, but we have to have adequate shore facilities at reasonable points for disposal. Also, the ports are going to have to recognize that they are going to have to pass regulations and ordinances and laws and have a program to keep their harbor clean. And I think this is going to be part of the program.

I also think--what Mr. Mayo is suggesting--that the States may want to consider getting their harbormasters and their groups getting started on that now, rather than waiting for the effective date of the Federal legislation.

Are there any other comments or questions?

If not, thank you.

Mr. Mayo?

MR. MAYO: As I understand it with regard to Bessemer, there is a question before the conferees on whether or not they want to concur in the extension of this date for chlorination facilities at Bessemer from

May 1970 to December 1, 1971?

MR. PURDY: That is correct.

MR. STEIN: And I also understand the reason for this is because you found that as far as Bessemer was concerned extensive alterations had to be made in the plant?

MR. PURDY: The present plant was totally unacceptable.

MR. STEIN: All right. How large is that Bessemer, about?

MR. PURDY: Thirty-three hundred people.

MR. STEIN: Is there any objection on this from any of the conferees?

MR. FRANGOS: We understand that the Michigan Commission has acted on this formally, Ralph, is that correct?

MR. PURDY: The Commission has held its statutory hearing and has adopted a final order and this is a final order date.

MR. FRANGOS: Well, we think, then, we would be guided by your State's technical judgment on the status and this appears reasonable to us.

MR. STEIN: All right.

If there is no objection, I will recommend this. Now you see what happens. This theoretically raises a sore point, because when you are doing this you are putting the Federal Government in the position of ratifying a fait accompli. If you can do that with a city of 3,300, I guess in principle it is no different in doing it with a city of 3 million.

MR. PURDY: Mr. Chairman, I might mention that the Commission held its hearing and adopted its final order prior to the recommendations of this conference.

MR. STEIN: Right.

Are there any other comments or questions?

If not, thank you very much.

Does Michigan have any more?

MR. PURDY: Well, I had better check on some of my people.

MR. STEIN: Yes.

MR. PURDY: Mr. Chairman, I would like to ask whether Dean Thomas Griffith of Northern Michigan University is in the audience today? He has requested that he be given an opportunity to make a statement.

THOMAS GRIFFITH

DEAN, SCHOOL OF ARTS AND SCIENCES

NORTHERN MICHIGAN UNIVERSITY

MARQUETTE, MICHIGAN

DEAN GRIFFITH: I have been requested by President John X. Jamrich, of Northern Michigan University, in Marquette, Michigan, to make the following statement.

(The following statement was read:)

Duluth Conference
April 28, 1970

I have been requested by John X. Jamrich, President of Northern Michigan University, to make the following statement to this conference:

Northern Michigan University, a university constitutionally established by the State of Michigan, is located in the Upper Peninsula of Michigan on the shores of Lake Superior. The principal mission of the University is to serve the people of Michigan through its three major programs of education, research, and service. Our programs serve all of the people of Michigan. Because of our location, we see a special responsibility to the people of Northern Michigan, especially in the areas of research and service. The faculty, through their professional training and experience, are well qualified to meet these obligations. Our faculty, many of them eminent in the fields of specialization, (e. g. ecology, microbiology, regional planning, demography, limnology) are an extremely valuable asset to communities, industry, and state and federal government agencies located in the Upper Lakes region.

We join with other universities in the area to provide expertise to help establish conditions in which tourism, industry, and other human endeavors can exist harmoniously. The problems we face are not only scientific or technical in origin or solution, but require the thinking of the social scientist and humanist. These unique concentrations of competencies exist only in the universities, and must be mobilized to seek long-term solutions to our problems.

We recognize the unique characteristics of Lake Superior and are committed to maintaining its value to the people of Michigan and the country. Our location on the lake makes it most appropriate that the University should be expected to collect and study data regarding the central region of the lake, as well as the immediate vicinity of Marquette. Industrial pollution by the Reserve Mining Company is only a part of the total problem. A continuing assessment and determination of the facts of municipal sewage disposal, ship and boat waste disposal, other industrial waste disposal, and shoreline use must be made, and the basis for real costs of each should be determined.

In summary, the University sees itself as a repository of expertise that can provide valuable and objective information to people of this area. It is a resource that should be heavily utilized.

Thank you. I appreciate the opportunity to be able to present this statement.

MR. STEIN: Thank you, Dean Griffith.

Any comments or questions?

If not, thank you very much.

DEAN GRIFFITH: Mr. Chairman, I have been asked by three members of the faculty to present short statements in their behalf. May I do so?

MR. STEIN: Go right ahead.

(The following statements were read:)

NORTHERN MICHIGAN UNIVERSITY
MARQUETTE, MICHIGAN 49855

OFFICE OF THE DEAN OF
ARTS AND SCIENCES

STATEMENT BY JOHN P. FARRELL TO BE DELIVERED AT THE CONFERENCE ON THE POLLUTION OF LAKE SUPERIOR APRIL 28-29, 1970

Statement 1. The Department of Geography at Northern Michigan University has involved undergraduate students in environmental research. This spring students started to gather data on air pollution in the immediate area of Marquette, Michigan. Preliminary evaluation of this data tends to show that the emmissions of the type produced by iron ore pelletizing plants are easily monitorable. At the present this air pollutant is a minor factor in our concern for the waters of Lake Superior, yet it is one that must be observed over time so that it does not become a major factor.

Statement 2. Surface current studies carried on by researchers in the Department of Geography at Northern Michigan University and the Department of Physics at the University of Michigan have established the rather definite counterclockwise pattern of surface flow of the Lake Superior Basin. This research has been carried on since 1965 and a large amount of data have been collected. This counterclockwise movement varies somewhat during the year but there is no doubt in the minds of the researchers that any emmissions to the surface of the Lake is very quickly carried to all parts of it. On the basis of these results it is hoped that no private company, municipalities, or governmental agencies are allowed to in any way to pollute the surface waters of Lake Superior. The effect of this pollution is not local but rather affects all of us on the Lake.

John P. Farrell

John P. Farrell
Department of Geography

NORTHERN MICHIGAN UNIVERSITY
MARQUETTE, MICHIGAN 49855

DEPARTMENT OF BIOLOGY

STATEMENT BY DR. MARTIN KOPENSKI TO BE DELIVERED AT THE CONFERENCE ON THE POLLUTION OF LAKE SUPERIOR APRIL 28-29, 1970

The unnatural alteration of the water quality of Lake Superior must be halted immediately. This must apply equally to the large industries dumping tailings and other materials into the lake, as well as to small communities allowing non- or poorly-treated sewage to enter.

Undoubtedly the aforementioned substances have affected the organisms of the primary producer (algae) and primary consumer (invertebrates) levels. This effect is difficult to detect and may seem insignificant to some. However, it is obvious that the obscurred alteration of lower trophic levels will subsequently be evident at the higher trophic levels. We cannot afford to wait for a catastrophic sign such as the contaminated fish of Lake Michigan to indicate that we have fouled this body of water.

The water quality criteria pertaining to the admittance of questionable substances into Lake Superior must be strictly enforced for both large and small concerns.

Martin Kopenski
Martin Kopenski

DEAN GRIFFITH: The third statement is in the form of a letter to Mr. Purdy from Professor William Robinson, Department of Biology.

(The following letter was read:)

April 24, 1970

Mr. Ralph W. Purdy, Executive Secretary
Michigan Water Resources Commission
Department of Natural Resources
Mason Building
Lansing, Michigan 48926

Dear Mr. Purdy:

I wish to have the following statement read into the minutes of the Federal Conference on Pollution of Lake Superior on April 29 and 30, 1970. I offer these suggestions as a biologist and as a citizen living on the shore of Lake Superior.

I attended the first meetings of this conference on May 12 and 13 a year ago and heard and studied the evidence of pollution in Lake Superior. I read the report of the September meetings. I am convinced that the alterations to the aquatic environment of Lake Superior are undesirable and extensive. I refer particularly to the dumping of finely ground taconite tailings by Reserve Mining Company, which have been shown to cross state lines, and the disposal of toxic nitrogen compounds by the DuPont plant, and numerous inadequacies in municipal treatment facilities.

No evidence was presented to show that continued disposal of wastes and accumulation of such materials in Lake Superior would solve the growing problem of polluted water. At a time when we are searching for solutions, no one should be permitted to continue to add to the problem. I am well aware of the short-term economic deficits which may be suffered by the present polluters. Nevertheless, I urge that the conferees apply their power of enforcement to halt immediately any further degradation of the quality of Lake Superior.

Sincerely,

William L. Robinson
Associate Professor

WLR:mf
cc: Dean Thomas Griffith

DEAN GRIFFITH: The last statement, with the Chairman's permission, will be read by Dr. Philip Doepke himself.

MR. STEIN: Right. (Applause.)

MR. PURDY: Thank you, Dean Griffith.

PHILIP A. DOEPKE
BIOLOGY DEPARTMENT
NORTHERN MICHIGAN UNIVERSITY
MARQUETTE, MICHIGAN

DR. DOEPKE: Thank you, Dean Griffith.

My name is Philip Doepke, Biology Department, Northern Michigan University. My background includes experience in fishery biology and the chemistry of lakes.

(The following statement was read:)

NORTHERN MICHIGAN UNIVERSITY
MARQUETTE, MICHIGAN 49855
DEPARTMENT OF BIOLOGY

STATEMENT TO THE FEDERAL CONFERENCE ON POLLUTION OF LAKE SUPERIOR AND ITS TRIBUTARY BASIN by PHILIP A. DOEPKE, BIOLOGY DEPARTMENT, NORTHERN MICHIGAN UNIVERSITY, April 29, 1970.

According to C. H. Mortimer in a paper given at the International Symposium on Eutrophication in April 1965, eutrophication is an increase in nutrient supply from soil and lake processes and from human activities in the drainage basin.

It is generally accepted that the process of eutrophication is characteristic for lakes. By this process a lake changes from a condition low in nutrient values, oligotrophy, to one high in nutrient values, eutrophy. Associated with the changes in chemical concentrations are changes in the biota and physical aspects of the lake. However, since each lake is unique, it is not possible to predict the rate or the magnitude of such changes in a lake subjected to an increased input of nutrients. At present Lake Superior is an oligotrophic lake, a condition that our nation desires to preserve.

The nutrient concentrations in a lake are the net of the inflows less the losses to the outflowing stream, to the removal of crops, and to the sedimented residues. The St. Mary's River annually drains about one-half of one percent of the volume of Lake Superior. The harvesting of plant, animal, or chemical crops as a means of substantially reducing nutrient concentrations in a lake the size of Lake Superior is economically unfeasible at present and almost certainly will remain so. To rely on a lake to naturally cleanse itself of excess nutrients through complexing in the sediments has only resulted in a history of despoiled lakes.

In summary, the possibility of reducing concentrations of nutrients once added to Lake Superior is remote. If we are to retain the high quality of water for which Lake Superior is admired, we must rigorously minimize material additions without undue delay.

Philip A. Doepke

Philip A. Doepke

DR. DOEPKE: Thank you. (Applause.)

MR. STEIN: Thank you, Dr. Doepke.

Any other comments or questions?

If not, thank you very much.

Mr. Purdy.

MR. PURDY: Yes, Mr. Chairman. I have a letter from Mr. Ted Pankowski of the UAW indicating that they would like to present a statement today. I had a telephone call from him prior to this meeting and he said that he would have a representative from Wisconsin here to present a statement for him. I am wondering if he is present?

(No response.)

Mr. Chairman, I have a copy of a letter addressed to Mr. Walter Hickel, Secretary of the Interior, from James L. Carter, Marquette, Michigan, and ask that this letter be entered into the record. I would like to enter this letter in the record for Mr. Carter.

MR. STEIN: Without objection, that will be entered into the record as if read.

(Which said letter is as follows:)

JAMES L. CARTER
P. O. BOX 492
MARQUETTE, MICHIGAN 49855

April 22, 1970

Mr. Walter Hickel
Secretary of the Interior
U. S. Department of the Interior
Washington, D. C.

Dear Mr. Hickel:

Please enter into the official record of the Federal-State enforcement conference on pollution of Lake Superior, to be held in Duluth on April 29-30, my objections to continued dumping of taconite tailings into the lake by the Reserve Mining Company.

I have lived on Lake Superior most of my life, and have published three books dealing with its history. As a newspaperman, I did some research on pollution problems of the Lake Superior Basin, and contacted officials in Michigan, Wisconsin, Minnesota and Ontario in gathering information. An extensive article was subsequently published in May of 1966 in a Michigan daily. My present position with the Department of Research & Development at Northern Michigan University keeps me in continual contact with water quality developments throughout the region.

Thus I would feel somewhat qualified to take an informed position on pollution problems, including that specific problem caused by Reserve Mining at Silver Bay. I strongly urge that the company be prohibited from using Lake Superior as a dumping area under any conditions or restrictions whatsoever, and that their present practice be terminated immediately.

I appreciate this opportunity to state my position for the record, as a private and concerned citizen.

Respectfully yours,

James L Carter

cc: Mr. Ralph Purdy
Michigan Department of
Natural Resources

MR. PURDY: The other request that I would like to make, Mr. Chairman, is that Michigan's report, even though it was not read in its entirety, will be placed in the record.

MR. STEIN: Pardon me, would you repeat that? I am sorry.

MR. PURDY: Mr. Chairman, even though our report was not read entirely, I would like to have it completely placed in the record.

MR. STEIN: Without objection, that will be entered into the record as if read.

(Which said report appears herein commencing on page 465.)

MR. PURDY: That is all that I have.

MR. STEIN: Thank you very much.

We will now call on Minnesota.

Mr. Badalich.

JOHN P. BADALICH, EXECUTIVE DIRECTOR
MINNESOTA POLLUTION CONTROL AGENCY
MINNEAPOLIS, MINNESOTA

MR. BADALICH: Thank you, Mr. Chairman, fellow conferees, ladies and gentlemen.

The Minnesota conferees are Mr. Robert C. Tuveson, the Chairman of the Agency seated at the far left, and Dr. Howard Andersen, Agency member, seated next to Mr. Tuveson, and myself as the Executive Director, John Badalich, of the Minnesota Pollution Control Agency.

Considerable progress has been made toward fulfillment of the recommendations contained in the summary of January 26, 1970. The Agency wishes to present the following summary relating to control of water pollution in this area since the executive session of October 1969.

The following comments refer to the identically numbered recommendation. You may wish to have the recommendations before you to follow my comments. Please note that some items have been omitted so as to avoid duplication or because the recommendation may not be relevant to Minnesota.

1. We support the recommendations of the Technical Committee on this matter. It should be noted for the record that our interstate water quality standards received final and complete approval from Secretary of the Interior Hickel on November 26, 1969. Lake Superior and other interstate waters of the basin are included among the waters covered by these standards. Our standards also include effluent requirements, whereby the dischargers in the State of Minnesota are treated alike and they will have to provide an effluent of the quality indicated in our standards.

I would like to read an excerpt from the letter of Walter J. Hickel to Governor LeVander when he did approve our standards. It reads as follows, and I quote:

"The revisions which I approve include special regulation for the Mississippi, Minnesota, and St. Croix Rivers which include effluent criteria. The Federal Act authorizes Federal approval of only water quality (stream) criteria and plans for implementing and enforcing these criteria. I am pleased that your agency will enforce the requirement which is more stringent if there is an incompatibility between the stream criteria and these special regulations."

Recommendation No. 2. The discharge of taconite tailings has been kept under surveillance to the extent permitted by our resources. We have no new findings to report.

3. Reserve Mining Company was requested to undertake studies relative to reducing the discharge of tailings to Lake Superior. The company is proceeding with these studies and on April 13 provided a working progress report.

Copies of the progress report have been made available to the conferees, and several other more detailed reports are also available for review. The working progress report does not include a proposal for a time schedule. Presumably this schedule will be included in the final report which is due by July 26.

Reserve Mining Company has been reporting on a monthly basis now for several months and the reports are available for review by the conferees should they so desire. The company has reported no adverse effects. The Agency, on March 3, requested the company to discontinue the discharge of fly ash to the lake and the company, by letter dated April 10, agreed to comply with that request. Land disposal sites currently are being reviewed with the company by Agency personnel.

Incidentally, I was just informed by my staff that for the last several days the company has been trucking fly ash to a land disposal area.

Before proceeding with review of the report submitted by the company, it is suggested that it would be desirable for the conferees to determine more specifically the objectives to be pursued in this matter. At present it appears we have a finding by the conferees that there is presumptive evidence of interstate pollution originating from this source, and we understand that some rather specific recommendations already have been made by the Department of the Interior designed to prohibit the travel of the tailings outside of the nine-square-mile discharge zone, either above or below the surface. The company is challenging the control standards of our Agency in court and the Agency has scheduled

May 12 through 14 in Duluth, Minnesota, a public hearing on possible revocation of the discharge permit. It would be helpful to us if the conferees could clarify their position on this situation so that the Agency is able to proceed in full knowledge of the wishes of the conferees in this matter.

4. The Agency prepared a grant application for a two-phase study to strengthen its program of monitoring the water quality of Lake Superior. In Phase 1 we will further investigate the use of cummingtonite as a tailings indicator by studying certain streams of the North Shore and eastern Mesabi Range, as well as other control waters. Comparisons will be made with waters known to receive tailings and streams flowing over the ore body and streams remote from the ore body, so as to establish the reliability of cummingtonite as an indicator of tailings. In Phase 2 we proposed to further investigate Lake Superior by using divers for selective depth sampling for suspended solids and chemical and physical properties of suspended fines. Underwater photography and spot sampling of green water areas would be coordinated with observations of green water

episodes reported by fishermen and others. After this application was drafted, financing difficulties were encountered. The application now has been redrafted to provide for additional staffing, and upon approval by the Department of Administration will be submitted for funding.

5. Secondary treatment facilities have been provided by all municipalities which discharge wastes to and/or affect interstate waters, except the following:

Carlton	Grand Marais
Cloquet	Scanlon
Duluth	Two Harbors

Cloquet and Grand Marais already have entered into stipulations with the Agency to provide such facilities before the recommended deadline of January 1974. In all cases an engineering consultant has been retained and studies are under way preparatory to providing preliminary plans and this is shown on Attachment No. A.

Just recently, a matter of just a day or so ago, the city of Duluth is proceeding and there is a possibility of a stipulation being entered into with the Agency at the May 11 meeting.

Item No. 6. Disinfection on a year-round basis is now provided by all such municipalities except Floodwood. All of these municipalities, as well as others in the basin, have been notified to comply with this recommendation by May 1, and all of those listed have chlorination equipment except for Floodwood, which has stabilization ponds. Effluent monitoring reports will be used to determine whether or not the coliform standard is being met when an effluent is discharged. If it cannot be met, installation of chlorination equipment or other control measures will be required at stabilization ponds also. See Attachment B for a detailed listing.

7. Those responsible for industrial effluents of this kind have been informed of this requirement. Recommendation No. 7 refers to continuous disinfection. Aside from sewage, the industries of this type in this area may include rendering plants, slaughterhouses, meatpacking plants, and wood pulp, paper and board mills. Only the latter category is known to discharge wastes directly to and/or affect interstate waters of the basin. These include the mills of Conwed and Northwest Paper

Company in Cloquet, and Superwood in Duluth. It is known also that sewage effluent is discharged without disinfection with the process wastes from the Superwood mill and the Duluth Works of the U. S. Steel Corporation.

The U. S. Steel Corporation has indicated to the Agency that chlorination facilities will be provided this summer. Conwed and the Northwest Paper Company have made extensive studies of their process wastes, from which sewage long has been excluded, and have found that the fecal coliform content can be kept well below the recommended level of 200 most probable number per 100 milliliters without chlorination. It is our understanding that Superwood intends to conduct studies at its mill, but we do not as yet have anything to report.

8. Our approved plan for implementing and enforcing the interstate water quality standards includes a requirement for phosphorus reduction by not later than November 1973 for all municipalities discharging to Lake Superior or its bays. This includes Duluth, Grand Marais, Silver Bay and Two Harbors. Grand Marais already has stipulated with the Agency to do this. Silver Bay has just executed a stipulation, but to this

date the stipulation has not been approved by the Agency. Discussions are under way with the others. If stipulations are not soon agreed upon, it is our intent to establish effluent standards in the near future and hold the necessary hearings and then issue orders to the recalcitrants and authorize prosecution.

This is a matter of information. At just the past Agency meeting the Agency did enter into 10 stipulations with various industries and municipalities on interstate systems, so this is quite a tool that we have in the State of Minnesota to get compliance without getting into enforcement hearings and the issuance of orders.

All of the remaining municipalities which discharge sewage effluent in the basin will be required to provide phosphorus reduction facilities in accordance with the following preliminary schedule:

Furnish engineering report by March 1971.

Furnish final plans by October 1971.

Award construction contract by April 1972.

Complete construction of works for chlorination--I am sorry--for phosphorus reduction by January 1975.

However, it should be noted that in many cases construction of the physical facilities needed for phosphorus reduction probably will be completed earlier than indicated above because this construction may proceed in concert with construction of secondary works, and completion of the latter in some cases is required by November of 1973.

Recommendation No. 9. The industries listed below are those which are known to discharge wastes in excess of our effluent standards to interstate waters. These industries do not at present provide secondary treatment or the equivalent, and have not yet formally committed themselves to do so by November 1973. These are:

Fitger Brewing Company, Duluth
Reserve Mining Company, Silver Bay
Superwood, Inc., Duluth
U. S. Steel Corporation, Duluth Works.

There is indication that progress might be made on the latter two prior to the May 11 meeting of the Agency.

It is our intent to proceed in much the same manner as indicated in item 8 above in regard to those failing to stipulate in the near future. As a general case, it does not appear that phosphorus reduction will be necessary for most of the industrial wastes discharged in the basin, assuming sewage is excluded, as the phosphorus content of the industrial wastes is likely to be either below 1 milligram per liter or present in insoluble and inert form. This question will be explored in more detail so that in the near future we trust more definitive answers will be available. For the present, it appears that the following are the industrial sources in the basin which are likely to need some form of phosphorus control:

Continental Oil Company, Wrenshall Refinery, Wrenshall;

Fitgers Brewing Company, Duluth;

Minnesota Power and Light Company, Aurora and Duluth;

Reynolds Foods, Inc., Duluth;

Yax Laundromat, Duluth.

In any case where it is found that removal of phosphorus from an industrial waste is necessary, it is assumed that the project schedule can extend to January 1975, if necessary, in the same manner as like projects for municipal effluents.

Item No. 10. This relates to the necessary corrective actions in the Lake Superior Basin and appraisal of the water pollution problems in the basin and this is attached as Attachments Nos. A and C.

Recommendation No. 11. This refers to unified collection systems and this has long been an Agency policy.

Recommendation 12. This refers to the States to accelerate water pollution control programs and provide maximum use of areawide treatment facilities. This has always been an Agency policy of long standing.

Recommendation No. 13. Those municipalities which are known to have or may have combined sewers and/or major sewage overflows and which discharge to and/or affect interstate waters are listed in Attachment D.

Floodwood is resolving these problems in conjunction with current construction of new sewage treatment works. Because of time limitations, it has not yet been possible to develop detailed plans for correcting these problems at all of the municipalities, although two others are proceeding with studies. The Agency will require the municipalities concerned to furnish the necessary engineering reports by not later than October 1971; and thereafter proceed with corrective measures to be completed by November 1979, in accordance with the approved implementation plan.

14. To the extent the Agency is involved in urban redevelopment, such projects will be required to conform. And this again relates to the existing combined sewers and separation of sewers. It has long been an Agency policy that combined sewers will not be approved for new developments.

Item No. 15 relating to pesticides and the concentration of DDT. The Minnesota Department of Agriculture recently held public hearings on a regulation to restrict the sale and use of the so-called hard pesticides. The Agency is represented on the Department of Agriculture's Advisory Committee.

The Agency applied for and received a grant to monitor pesticides in the Lake Superior Basin. The study will be performed under contract, and field work is now beginning. There are yet no data upon which to report.

Item No. 16. It is assumed that as a result of recent action by the Congress the Federal Water Quality Administration soon will be promulgating criteria for acceptable units for all types and sizes of watercraft.

Minnesota will be happy to use such criteria when they are available, and in the meantime we subscribe to the policy statement on this matter which was adopted by the Lake Michigan conferees.

Recommendation No. 17. This relates to the dumping of polluted dredge material in Lake Superior. We are not aware of any such dumping by State or local agencies, or private concerns.

18. The Minnesota Soil and Water Conservation Commission has been informed of this recommendation and have been requested to provide technical advice on the Minnesota program should that be desired at this time and this relates to the control of soil erosion.

We trust you will agree with the significant progress that has been made since our previous session. Should any further information or clarification be desired, we shall be glad to so provide it.

I thank you, Mr. Chairman.

And I would like to have the entire statement, including the attachments, presented in the record.

MR. STEIN: Without objection that will be entered into the record as if read.

(Which said statement is as follows:)

STATE OF MINNESOTA
POLLUTION CONTROL AGENCY

Statement for Second Federal-State Conference on Pollution of the Interstate Waters of Lake Superior and its Tributary Basin

Duluth
April 29, 1970

The Minnesota conferees are Robert C. Tuveson, Chairman of the Agency; Dr. Howard Andersen, Agency member, and John P. Badalich, Executive Director.

Considerable progress has been made toward fulfillment of the recommendations contained in the summary of January 26, 1970. The Agency wishes to present the following summary relating to control of water pollution in this area since the executive session of October 1969.

The following comments refer to the identically numbered recommendation. You may wish to have the recommendations before you as you follow my comments. Please note that some items have been omitted so as to avoid duplication, or because the recommendation may not be relevant to Minnesota.

1. We support the recommendations of the technical committee on this matter. It should be noted for the record that our interstate water quality standards received final and complete approval from Secretary Hickel on November 26, 1969. Lake Superior and other interstate waters of the basin are included among the waters covered by these standards.
2. The discharge of taconite tailings has been kept under surveillance to the extent permitted by our resources. We have no new findings to report.
3. Reserve Mining Company was requested to undertake studies relative to reducing the discharge of tailings to Lake Superior. The Company is proceeding with these studies and on April 13 provided a working progress report.

Copies of the progress report have been made available to the conferees, and several other more detailed reports also are available for review. The working progress report does not include a proposal for a time schedule. Presumably this schedule will be included in the final report which is due by July 26.

Reserve Mining Company has been reporting on a monthly basis now for several months and the reports are avilable for review by the conferees should they so desire. The Company has reported no adverse effects.

The Agency, on March 3, requested the Company to discontinue the discharge of fly ash to the lake and the Company, by letter dated April 10, agreed to comply with that request. Land disposal sites currently are being reviewed with the Company by Agency personnel.

Before proceeding with review of the reports submitted by the Company, it is suggested that it would be desirable for the conferees to determine more specifically the objectives to be pursued in this matter. At present it appears we have a finding by the conferees that there is presumptive evidence of interstate pollution originating from this source, and we understand that some rather specific recommendations already have been made by the FWQA designed to prohibit the travel of the tailings outside of the nine square mile discharge zone, either above or below the surface. The Company is challenging the control standards in court, and the Agency has scheduled for the near future a public hearing on possible revocation of the discharge permits. It would be helpful to us if the conferees could clarify their position on this situation so that the Agency is able to proceed in full knowledge of the wishes of the conferees in this matter.

4. The Agency prepared a grant application for a two phase study to strengthen its program of monitoring the water quality of Lake Superior. In Phase 1

we will further investigate the use of cummingtonite as a tailings indicator by studying certain streams of the North Shore and the eastern Mesabi Range, as well as other control waters. Comparisons will be made with waters known to receive tailings and streams flowing over the ore body and streams remote from the ore body, so as to establish the reliability of cummingtonite as an indicator of tailings. In Phase 2 we proposed to further investigate Lake Superior by using divers for selective depth sampling for suspended solids and chemical and physical properties of suspended fines. Underwater photography and spot sampling of green water areas would be coordinated with observations of green water episodes reported by fishermen and others. After this application was drafted, financing difficulties were encountered. The application now has been redrafted to provide for additional staffing, and upon approval by the Department of Administration will be submitted for funding.

5. Secondary treatment facilities have been provided by all municipalities which discharge wastes to and/or affect interstate waters, except the following.

    Carlton
    Cloquet
    Duluth
    Grand Marais
    Scanlon
    Two Harbors

    Cloquet and Grand Marais already have entered into stipulations with the Agency to provide such facilities before the recommended deadline of January 1974. In all cases an engineering consultant has been retained and studies are underway preparatory to providing preliminary plans. See also Attachment A.

6. Disinfection on a year round basis is now provided by all such municipalities except Floodwood. All of these municipalities, as well as others in the basin, have been notified to comply with this recommendation by May 1, and

all of those listed above have chlorination equipment except for Floodwood, which has stabilization ponds. Effluent monitoring reports will be used to determine whether or not the coliform standard is being met when an effluent is discharged. If it cannot be met, installation of chlorination equipment or other control measures will be required at stabilization ponds also. See Attachment B for a detailed listing.

Those responsible for industrial effluents of this kind have been informed of this requirement. Aside from sewage, the industries of this type in this area may include rendering plants, slaughter houses, meat packing plants, and wood pulp, paper and board mills. Only the latter category is known to discharge wastes directly to and/or affect interstate waters of the basin. These include the mills of Conwed and Northwest Paper Company in Cloquet, and Superwood in Duluth. It is known also that sewage effluent is discharged without disinfection with the process wastes from the Superwood mill and the Duluth Works of the U. S. Steel Corporation.

The U. S. Steel Corporation has indicated to the Agency that chlorination facilities will be provided this summer. Conwed and the Northwest Paper Company have made extensive studies of their process wastes, from which sewage long has been excluded, and have found that the fecal coliform content can be kept well below the recommended level of 200 MPN/100 ml. without chlorination. It is our understanding that Superwood intends to conduct studies at its mill, but we do not as yet have anything to report.

8. Our approved plan for implementing and enforcing the interstate water quality standards includes a requirement for phosphorus reduction by not later than November 1973 for all municipalities discharging to Lake Superior or its bays. This includes Duluth, Grand Marais, Silver Bay and Two Harbors. Grand Marais

already has stipulated with the Agency to do this, and discussions are underway with the others. If stipulations are not soon agreed upon, it is our intent to establish effluent standards in the near future and then either issue orders to the recalcitrants or authorize prosecution.

All of the remaining municipalities which discharge sewage effluent in the basin will be required to provide phosphorus reduction facilities in accordance with the following preliminary schedule:

Furnish engineering report by March 1971.
Furnish final plans by October 1971.
Award construction contact by April 1972.
Complete construction of works by January 1975.

However, it should be noted that in many cases construction of the physical facilities needed for phosphorus reduction probably will be completed earlier than indicated above because this construction may proceed in concert with construction of secondary works, and completion of the latter in some cases is required by November 1973.

9. The industries listed below are those which are known to discharge wastes in excess of our effluent standards to interstate waters. These industries do not at present provide secondary treatment or the equivalent, and have not yet formally committed themselves to do so by November 1973.

These are:
Fitger Brewing Company, Duluth
Reserve Mining Company, Silver Bay
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U. S. Steel Corporation, Duluth Works

It is our intent to proceed in much the same manner as indicated in item 8 above in regard to those failing to stipulate in the near future.

As a general case, it does not appear that phosphorus reduction will be necessary for most of the industrial wastes discharged in the basin, assuming sewage is excluded, as the phosphorus content of the industrial wastes is likely to be either below 1 mg/l. or present in insoluble and inert form.

This question will be explored in more detail so that in the near future we trust more definitive answers will be available. For the present, it appears that the following are the industrial sources in the basin which are likely to need some form of phosphorus control:

Continental Oil Company, Wrenshall Refinery, Wrenshall
Fitgers Brewing Company, Duluth
Minnesota Power and Light Company, Aurora and Duluth
Reynolds Foods, Inc., Duluth
Yax Laundromat, Duluth

In any case where it is found that removal of phosphorus from an industrial waste is necessary, it is assumed that the project schedule can extend to January 1975, if necessary, in the same manner as like projects for municipal effluents.

10. This information is provided in Attachments A and C.

11. This long has been an Agency policy.

12. This also is an Agency policy of long standing.

13. Those municipalities which are known to have or may have combined sewers and/or major sewage overflows and which discharge to and/or affect interstate waters are listed in Attachment D.

    Floodwood is resolving these problems in conjunction with current construction of new sewage treatment works. Because of time limitations, it has not yet been possible to develop detailed plans for correcting these problems at all of the municipalities, although two others are proceeding with studies. The Agency will require the municipalities concerned to furnish the necessary engineering reports by not later than October 1971; and thereafter proceed with corrective measures to be completed by November 1979, in accordance with the approved implementation plan.

14. To the extent the Agency is involved in urban redevelopment, such projects will be required to conform. It long has been an Agency policy that combined

sewers will not be approved for new developments.

15. The Minnesota Department of Agriculture recently held public hearings on a regulation to restrict the sale and use of the so-called hard pesticides. The Agency is represented on the Department of Agriculture's Advisory Committee.

    The Agency applied for and received a grant to monitor pesticides in the Lake Superior basin. The study will be performed under contract, and field work is beginning. There are as yet no data upon which to report.

16. It is assumed that as a result of recent action by the Congress the Federal Water Quality Administration soon will be promulgating criteria for acceptable units for all types and sizes of watercraft.

    Minnesota will be happy to use such criteria when they are available, and in the meantime will subscribe to the policy statement on this matter which was adopted by the Lake Michigan conferees.

17. We are not aware of any such dumping by state or local agencies, or private concerns.

18. The Minnesota Soil and Water Conservation Commission has been informed of this recommendation and requested to provide technical advice on the Minnesota program should that be desired at this time.

We trust you will agree that significant progress has been made since our previous session. Should any further information or clarification be desired, we shall be glad to provide it. Thank you.

John P. Badalich
Executive Secretary and
Chief Executive Officer

Attachments

A. Preliminary action plan and completion schedules for sources discharging to interstate waters, and listing of sources.

B. Status of chlorination at municipalities on interstate waters.

C. Listing of intrastate sources needing phosphorus reduction.

D. Listing of combined sewer systems discharging to interstate waters.

Attachment A

MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality

Preliminary Listing of Sources of Wastes Which are Discharged to and/or May Affect Interstate Waters of the Lake Superior Basin
April, 1970

SEWAGE

Carlton

Cloquet

Duluth (Main & Three District plants)

Erie Mining Company, Taconite Harbor

Floodwood

Grand Marais

Minnesota Department of Conservation, Jay Cooke State Park

Scanlon

Silver Bay

Superwood Corporation, Duluth

Two Harbors

U. S. Steel Corporation, Duluth Works, Duluth

INDUSTRIAL WASTES

Conwed Corporation, Cloquet

Erie Mining Company, Taconite Harbor Power Plant

Fitgers Brewing Company, Duluth

Minnesota Power and Light Company, Hibbard Plant, Duluth

Northwest Paper Company, Cloquet

Reserve Mining Company, E. W. Davis Works, Silver Bay

Superwood Corporation, Duluth

Two Harbors Power Plant

U. S. Steel Corporation, Duluth Works, Duluth

Attachment A

MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality

Preliminary Action Plan and Completion Schedule for Construction
of Treatment Works to Conform with Recommendations of Lake Superior
Enforcement Conference as set forth in Summary of Janurary 26, 1970

April, 1970

Waste Treatment and/or Control Task	Listed in FY 70 I & E Plan with Requirement for Nutrient Reduction(1)	Other Sources which Discharge to or otherwise affect Interstate Waters(2)	Sources which otherwise affect only Intrastate Waters(3)
Effluent disinfection or equivalent	---	May, 1970	May, 1970
Retain consulting engineer	---	Sept., 1970	Sept., 1970
Engineering report on secondary treatment and/or phosphorus reduction	March, 1971	March, 1971	March, 1971
Authorize final plans	April, 1971	April, 1971	April, 1971
Final plans on secondary treatment and/or phosphorus reduction	Oct., 1971	Oct., 1971	Oct., 1971
Engineering report on sewer separation	Oct., 1971	Oct., 1971	Oct., 1971
Financing arrangements	Jan., 1972	Jan., 1972	Jan., 1972
Award contract for secondary works and/or phosphorus reduction	April, 1972	April, 1972	April, 1972
Initial contract for sewer separation	April, 1972	April, 1972	April, 1972
Secondary works completed and in operation	Nov., 1973	Nov., 1973	Jan., 1975
Tertiary works completed and in operation	Nov., 1973	Jan., 1975	Jan., 1975
Sewer Separation projects completed	Nov., 1979	Nov., 1979	Nov., 1979

(1) Included only municipalities which discharge sewage directly to an interstate lake, bay or reservoir.
(2) Normally includes some sources which do not discharge directly to interstate waters but because of proximity or inadequate treatment may nevertheless cause violation of standards for interstate waters.
(3) Except for possible discharge of nutrients.

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MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality
Section of Enforcement

Status of Scheduled Construction of Treatment Works for Wastes which are Discharged to and/or Affect Interstate Waters of the Lake Superior Basin(1)

April, 1970

Source and Remaining Control Tasks	Status
Cloquet	
Preliminary financing arrangements for expansion of sewage treatment facilities	A preliminary engineering report on joint treatment with the industries has been provided. A letter from the city dated February 6 indicates the City will proceed with planning for joint treatment with N.W. Paper Co. and CONWED.
Construction and operation of pilot plant and analysis of data by August 12, 1970.	
Preparation of final basis of design and estimates of costs for treatment facilities by October 12, 1970.	
Negotiations for final contract for joint treatment facilities by December 12, 1970.	
Preparation of plans and specifications for treatment facilities by November 12, 1971.	
Submittal of plans and specifications to appropriate authorities for approval.	
Advertisement for bids, bid analysis and award of contract, subject to approval of agency granting construction funds by January 12, 1971.	
Agency approval for granting construction funds.	
Construction of treatment facilities by November 12, 1973.	

(1) Includes only those schedules which are incorporated in an order or stipulation.

Source and Remaining Control Work	Status
Conwed Corporation Cloquet	
Preliminary financing arrangements for expansion of treatment facilities	A letter dated February 9, from CONWED indicates the company will proceed with planning for joint treatment with Cloquet and N.W. Paper if this method proves to be of least cost to the company.
Construction and operation of pilot plant and analysis of data by August 12, 1970.	
Preparation of final basis of design and estimate of costs for treatment facilities by October 12, 1970.	
Negotiations for final contract for joint treatment facilities by December 12, 1970.	
Preparation of plans and specifications for treatment facilities by November 12, 1971.	
Submittal of plans and specifications to appropriate authorities for approval.	
Advertisement for bids, bids analysis and award of contract, subject to approval of agency granting construction funds by January 12, 1971.	
Agency approval for granting construction funds.	
Construction of treatment facilities by November 12, 1973.	
Grand Marais	
Engineering report for secondary and tertiary sewage treatment facilities by April 30, 1970.	A consulting engineer has been retained for design and preparation of plans for secondary and teriary treatment works.
Construction plans for secondary and tertiary sewage treatment facilities by December 30, 1970.	
Contract awarded for secondary and tertiary sewage treatment facilities by March 30, 1971	
Secondary and Tertiary sewage treatment facilities completed by September 30, 1972.	
The Northwest Paper Company, Cloquet	
Preliminary financing arrangements for expansion of treatment facilities.	A letter from the company dated February 6 indicates the company will proceed with planning for joint treatment with Cloquet and CONWED.

Source and Remaining Control Tasks	Status
The Northwest Paper Company, Cloquet - continued	
Construction and operation of pilot plant and analysis of data by August 12, 1970	
Preparation of final basis of design and estimate of costs for treatment facilities by October 12, 1970.	
Negotiations for final contract for joint treatment facilities by December 12, 1970.	
Preparation of plans and specifications for treatment facilities by November 12, 1971.	
Submittal of plans and specifications to appropriate authorities for approval.	
Advertisements for bids, bids analysis and award for contract, subject to approval of agency granting construction funds by January 12, 1971.	
Agency approval for granting construction funds.	
Construction of treatment facilities completed by November 12, 1973.	

R. D. Miller, Acting Chief
Section of Enforcement

Attachment [illegible]

MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality
Section of Enforcement

Status of Compliance with Effluent Disenfection Requirements for Municipal Wastewater Treatment Plans which Discharge to Interstate Waters of the Lake Superior Basin

April, 1970

Source	Year Round Chlorination
Carlton	yes
Cloquet	yes
Duluth	yes
Floodwood	no(1)
Grand Marais	yes
Scanlon	yes
Silver Bay	yes
Two Harbors	yes

---

(1) Stabilization ponds currently being constructed.

Attachment [illegible]

MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality

Preliminary Listing of Sewage and Industrial Waste Sources in the Lake Superior Basin which may need Phosphorus Reduction for Compliance with Recommendations of Enforcement Conference(1)

April, 1970

SEWAGE

Aurora

Babbitt

Biwabik

Buhl

Carlton

Chisholm

Cloquet

Duluth

Erie and Taconite Harbor Mining Co., Hoyt Lakes Plant

Eveleth

Eveleth Taconite Co., Forbes

Floodwood

Franklin(2)

Fraser

Gilbert

Grand Marais(3)

Hibbing

Hoyt Lakes

Iron Junction

Kinney

Leonidas

McKinley

Meadowlands

Nichols Twp.

Minnesota Dept. of Conservation, Jay Cooke State Park

Mountain Iron

St. Louis County, Nopeming Sanatorium

Scanlon

Silver Bay

Stuntz Twp., Kelly Lake Community

Superwood Corp., Duluth

Thompson Twp., Esko Community

Two Harbors

U. S. Steel Corp., Duluth Works and MinnTac Plant(2)

Virginia

Wrenshall

INDUSTRIAL WASTE

Anderson Dairy, Inc., Carlton(2)

Arrowhead Blacktopping, Duluth

Arrowhead Refining Co., Duluth

Arrowhead Sand and Gravel Co., Duluth

Continental Oil Co., Wrenshall Refinery

Conwed Corp., Cloquet

Coons Pacific Co., Coons-Pacific Concentrator, Eveleth(2)

Dow Chemical Co., Biwabik(2)

Duluth, Misabe & Iron Range Railroad Co., Proctor

East Range Gravel Co., Biwabik(2)

Eveleth Taconite Co., Fairlane Plant, in St. Louis County and Thunderbird mine in Eveleth(2)

Fitger Brewing Co., Duluth

Hanna Mining Company,
Domestic Iron Ore Division
  Agnew No. 2 Mine, St. Louis County
  Duncan Washing Plant, St. Louis County
  Pierce Group Mine and Concentrator, Hibbing(2)
  South Agnew Mine, St. Louis County

Jones and Laughlin Steel Corporation,
Minnesota Ore Division,
  Gilbert Mine, Gilbert
  Hobart Mine, Gilbert
  JL - 51 Mine, Gilbert
  JL - 52 Mine, Gilbert

Minnesota Power and Light Co., Hibbard Plant at Duluth, and Hoyt Lakes Plant

Northwest Paper Co., Cloquet

Pickands Mather and Company,
Mine Operating Organization,
  Erie Mine, Aurora
  Hoyt Lakes Taconite Plant, Aurora(2)
  Mahoning Group Mines & Concentrator St. Louis County(2)
  Taconite Harbor Power Plant

Pittsburg Pacific Company,
  Coons Mine, Virginia
  Dale Mine, St. Louis County
  Dunwoody Mine, St. Louis County
  Julia Concentrator, Virginia(2)
  Leonard - Burt Mine, Chisholm
  Leonidas Mine, Leonidas
  Lincoln Mine, Franklin
  McEwen Mine, Franklin
  Meadow Concentrator, Aurora(2)
  Monroe - Tener Mine, Chisholm
  Wyoming Mine, Franklin

Reserve Mining Co., E.W. Davis Works and Power Plant, Silver Bay, Peter Mitchell Mine at Babbitt

Reynolds Foods, Inc., Duluth

Rhude and Fryberger, Inc.,
  Gross - Nelson Mine and Concentrator, Eveleth(2)
  Hull - Nelson Mine, Eveleth
  Hull - Rust Mine and Concentrator, Hibbing(2)

Snyder Mining Company
  Wanless Mine, Buhl
  Whiteside Mine and Concentrator, Buhl(2)
  Woodbridge Mine, Buhl

Superwood Corp., Duluth

Two Harbors Aggregate Co., Two Harbors(2)

Two Harbors Power Plant

United States Steel Corporation,
Minnesota Ore Operations,
  Culver Mine, Buhl
  Forster Mine, St. Louis County
  Fraser Mine, Fraser
  Great Western Mine, Virginia

Humphrey Mine, Chisholm
Iron Chief Mine, Buhl
Kosmerl Mine, Buhl
MinnTac Mine and Plant, Mountain Iron(2)
PiloTac Plant, Mountain Iron
Rouchleau Mine and Concentrator, Virginia(2)
St. Clair Mine, Chisholm
Sauntry Mine, Franklin
Sharon Mine, Buhl
Sherman Mine and Concentrator, Fraser(2)
Stephens Mine and Concentrator, St. Louis County(2)

Union Carbide Co., Babbitt(2)

Yax Laundry, Duluth

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(1) Does not include federal establishments.

(2) May be exempt because there is no discharge of effluent to surface waters or source is connected to another system.

(3) Has signed stipulation with Agency.

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ATTACHMENT D

MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality

Status of Sewer Separation Studies by Municipalities
Which Have Sanitary Sewers and Discharge to or May Affect Interstate Waters
of the Lake Superior Basin 1/
April 22, 1970

Municipality	Combined Sewers and/or Major Overflows	Year of first Sanitary Sewer Construction	Engineering Report Requested by	Study in Progress?	Engineering Report Received?	Remarks
Carlton	yes	1914	May, 1970	yes	--	--
Cloquet	yes	1905	May, 1970	yes	--	--
Duluth	yes	1883	--	--	yes	Plans prepared and application to HUD for one of remaining projects
Floodwood	yes	Und.	--	--	yes	Sewage treatment works are under construction and any defects are being corrected concurrently.
Grand Marais	yes	1933	--	--	yes	Report being reviewed.
Scanlon	Und.	1941	--	--	--	--
Silver Bay	yes	1953	July, 1970	yes	--	--
Two Harbors	yes	1894	--	--	yes	--

Und. - Undetermined

1/ The dates shown by which engineering reports are due are based on recommendations made as a result of adoption of the plan for implementation and enforcement of the interstate water quality standards in June, 1967. As approved by Secretary Hickel the interstate water quality standards now require completion of works of this type by not later than November, 1979.

MR. STEIN: Are there any comments or questions?

MR. MAYO: I have some questions, Mr. Chairman.

On page 6 at the top of the page you identified the Yax Laundromat. Is this a separate discharge into the lake aside from the city?

MR. BADALICH: I will get myself oriented here, Mr. Mayo. This is on page number 6?

MR. MAYO: Right. Near the top of the page you identify five industrial commercial dischargers.

MR. BADALICH: Yes.

MR. MAYO: The Yax Laundromat. Is this a separate discharge?

MR. BADALICH: Yes, it is a separate discharge; but in working out the stipulations with a lot of the industries in Duluth, and also with the city of Duluth, we have a time schedule set in our stipulation indicating the choice to be made with the industry to either go into the municipal system or to do it alone. In this particular case they are asked to make a determination and I believe it will be sometime this late summer, and if they do not go into the municipal system, why, then they will be required to provide their own phosphorus control.

MR. MAYO: On page 4 in connection with your report on Recommendation No. 17, you identify Conwed and Northwest Paper Company as having made extensive studies of their process wastes from which sewage has been excluded, and they found that the fecal coliform content is below the 200 MPN per 100 milliliters. Now, are these people contending that they should not be required to meet the chlorination date identified by the conferees for May 1970?

MR. BADALICH: If the fecal coliform content is less than the 200 most probable number, they will not provide disinfection.

MR. MAYO: Is the State going to concur in that?

MR. BADALICH: Yes, I believe we will, Mr. Mayo.

MR. MAYO: I would certainly invite some comments from the conferees on that point.

MR. STEIN: Are there any comments?

Let me ask a question. Are Conwed and Northwest Paper Company complying with the effluent standards of your State?

MR. BADALICH: Mr. Chairman, we have a stipulation entered into with the Conwed Corporation and Northwest Paper. This was part of our interstate water quality package and I believe this was the first stipulation the Agency entered into. This was submitted as our interstate package and approved by the Secretary of the Interior. So they do provide secondary biological treatment.

MR. STEIN: Are they providing it now or are they--

MR. BADALICH: No, they will be providing it.

MR. STEIN: They will be providing it?

MR. BADALICH: Under a separate--

MR. STEIN: Yes. I don't want to get off this point, and I want to commend you on a very candid report.

Have you got anything else?

We will turn this back to Mr. Mayo in a moment. But as I read your report, here is what we have.

I think the State is moving ahead against the major sources on the lake, but you have secondary facilities and you have listed six major cities. You have got two out of the six, Cloquet and Grand Marais; Carlton, Duluth, Scanlon and Two Harbors not yet. You have got stipulations from Conwed and Northwest on that, but there are four industries who have not yet committed themselves and I guess when you read them, the name of the four, you go up and down the lake, you have got the brass ring, Fitger Brewing, Reserve Mining, Superwood and U. S. Steel. That is a good group.

MR. BADALICH: They sure are. (Laughter.)

MR. STEIN: It seems to me that we still have the large industries to deal with.

Then on chlorination--

MR. BADALICH: Before you proceed any further, Mr. Chairman, we have listed these as not entering into a stipulation at this present time, but we are still committing ourselves to the May 1973 completion date or possibly November 1973, and if we do not get a stipulation within a certain time limit that we have already specified to them, then we will immediately go into an enforcement hearing and issuing orders.

MR. STEIN: Yes.

MR. BADALICH: So you can rest assured that the deadline date that we specified here of May or

November of 1973 will be adhered to.

MR. STEIN: Yes, I recognize that and I said you had a very candid report on that. I do think, though, in any request you give us we are going to back you on this, Mr. Badalich. You have got a big league job ahead of you. I was just looking down the roster of the industries that you are taking on. I know what this is because I have done this many times myself.

And also on the phosphorus you have got Grand Marais and Silver Bay with a stipulation anyway on its way, but you don't have Duluth and Two Harbors yet. So I would say the evaluation is I think that, at least in my opinion, the State has mounted a very aggressive program of pollution control here. However, the record shows that you have not arrived at agreements with a considerable number of substantial dischargers in the area and I hope they are not recalcitrants and I wish you luck.

MR. BADALICH: I am sure at the time you reconvene in August, I believe as you indicated yesterday, Mr. Chairman, I would like to report that maybe these large and significant dischargers will be under a stipulation.

MR. STEIN: Right.

MR. MAYO: I would like to continue to speak for a moment to your item No. 7 on page 4, at this time with respect to Superwood. Your statement is that it is your understanding that Superwood intends to conduct studies at its mill, but you haven't yet--apparently they don't yet have anything to report.

Are we to understand that with all the time that has been available to Superwood to provide the chlorination facilities by May 1970 they are just beginning to study it?

MR. BADALICH: I think, Mr. Mayo, that is what the statement says, and I don't know whether I have anything else to report from the staff, but I believe they are making coliform determinations as of right now.

Maybe I could ask Mr. Koonce. Do you have any report from Superwood, Mr. Koonce?

MR. KOONCE: I think they are making progress. They are in a position of moving towards employment of consulting engineers.

MR. MAYO: What is the next target date that

Superwood is to meet in connection with your water quality standards compliance? Is there an interim date that they are to meet?

MR. BADALICH: Yes. We have already given them a stipulation to review, and I have already been authorized by the Agency that in the event the stipulation is not signed by the next Agency meeting we will enjoin them in court, and I believe it is being worked on right now. The details of the stipulation are being worked out by my Special Assistant Attorney General and their legal representative and I hope that we can reach agreement in the next week or so.

MR. MAYO: It is my understanding that there is a May 26 target date?

MR. BADALICH: The final date for completion of all the interstate sources is May 26 of 1973.

MR. MAYO: That is the final date?

MR. BADALICH: That is the final date for providing secondary biological treatment or the equivalent according to our effluent requirements.

MR. MAYO: As I understand, Superwood is required under an interim date in the standards to have preliminary plans submitted by the 20th of May, 1970?

MR. BADALICH: I believe that date is correct. I am not certain at this--no, I think it is a little longer than that, Mr. Mayo, because we have given them an alternative in the stipulation to either go it alone, if they so desire--and they have to make this commitment I believe by August of this year, August or September, I haven't got the stipulation with me--or they either can go into pretreatment and discharge into the city of Duluth system or they can discharge their entire waste into the city of Duluth system. And this determination will be made. I believe the date that we have established is September of this year. This ties in with the stipulation that we have with the city of Duluth that we are working on with them, indicating to them at the same time they have to provide or let the industries know what the industrial user charge might be. So, we are working hand in hand with the large industrial sources and also this will give the city an indication on how they have to design their facilities. The original design the city of Duluth submitted to us does not take into account the large industrial source of Superwood, so this was referred back to them and in the event that the Superwood Corporation goes into the city of Duluth, they might have to double their capacity.

MR. MAYO: When will Superwood be required to provide you with preliminary plans? Is that date established?

MR. BADALICH: I believe it is--I will have to ask my staff here.

Mr. Smith or Richie?

MR. MILLER: For secondary treatment it would be October 1970 and for tertiary treatment it would be January 1971.

MR. STEIN: And those are both preliminary plans?

MR. MILLER: Yes, sir.

MR. STEIN: If we meet in August we won't hear from Superwood again except we might hear they are making progress and they hired an engineer? (Laughter.)

MR. BADALICH: No, Mr. Chairman, we will be hearing from Superwood a lot sooner than that. As I indicated, it will be May 11 at the next Agency meeting. I think we will know there whether we will be into a court suit with them or whether we will have them under stipulation, and there will be--

MR. STEIN: How do you know that by May 11th-- the point is when do they have to make a choice whether they are going to go it alone or go into the joint system, on what date?

MR. BADALICH: That is September 30th of 1970.

MR. STEIN: Yes, but how will you know May 11 whether they are going to be in compliance or not?

MR. BADALICH: No. What I am saying here is that under our procedures now to get the industries in compliance we are either going to do it by a stipulation route or in this particular case injunction.

MR. STEIN: I understand that.

MR. BADALICH: And if we do not have the stipulation signed by this date we will then enjoin them.

MR. STEIN: Right. In other words, now, let me ask you this, because I am trying to get information.

Let's suppose we come back in August. Would it be fair to say at that time we can expect, at least ask the question, that you may have entered into a stipulation with all these, including Superwood, and Superwood would say in that stipulation either they are going to go it alone and provide adequate treatment or they are going to join with the city?

MR. BADALICH: That is correct.

MR. STEIN: Is that correct?

MR. BADALICH: That is correct.

MR. STEIN: All right, thank you.

MR. MAYO: I would just like to clarify a point.

It is my understanding, Mr. Badalich, that in your water quality standards there is an interim date for the submission of preliminary plans by Superwood by May 26, 1970. Now, I also understand from your comments that the State of Minnesota has by stipulation extended that date.

I want to make it clear that if that is the case, as of this point in time the Department of the Interior has not consented to the extension of that date.

MR. BADALICH: What date are you referring to, to the date for submission of plans?

MR. MAYO: Yes.

MR. BADALICH: That is not part of the interstate water quality implementation plan. The portion of your implementation plan we are concerned with is the final completion date. The interim dates are worked out with our agency. And I think there is enough flexibility in this that we still meet the final completion date, which in our case is May 26, 1973.

MR. MAYO: I think Mr. Stein earlier expressed this point, in response to Mr. Purdy, that where there are interim dates established and the State wishes to extend or modify those interim dates, that this should be done with the concurrence of the Regional Office of FWQA. If the extension of that date is such that it is apparent that the discharger is not going to meet the final date, then FWQA in Washington will get involved in the appraisal of the reasonableness of that extension.

The point that I want to make is that the State in making the stipulation with Superwood to extend that date has not done so in consultation with the Regional Office of FWQA, and we have not consented to that extension.

MR. BADALICH: Mr. Mayo, this is a regulation that I am not aware of. In our implementation plan, in our compliance schedule we submitted to the Department of the Interior for approval or our interstate water quality standards, we indicated a final completion date which was concurred in. There were no intermediate dates. And if you think I am going to have my implementation program or my compliance schedule reviewed by the Feds in Chicago every time we move, I think you have another guess coming on this one. (Laughter.) I think we can handle our own State program. (Applause.)

MR. MAYO: This is a point that certainly needs to be addressed to, Mr. Badalich. That is the reason I raised it, because it was brought up by Mr. Purdy earlier; Mr. Stein addressed himself to it; and I think as far as this conference is concerned it is opportune to discuss this particular action to the extent that it becomes related to Mr. Purdy's question, and I just wanted to make that point clear.

MR. BADALICH: No, we did not submit an interim date to you and we don't expect to.

MR. MAYO: O. K.

MR. BADALICH: This is our program and certainly we are partners in this, but I certainly don't want to work with the Feds looking over my shoulder every step I move along the line.

MR. MAYO: O. K. Now, you did--

MR. BADALICH: We are giving you a final completion date and this is exactly the date that we are going to comply with. In the event there is any deviation from this, yes, you will so be notified and that is very clearly spelled out in our interstate water quality standards.

MR. MAYO: You did submit a typical set of interim schedules?

MR. BADALICH: Yes, we submitted a typical interim schedule. But then again, based on the circumstances, the intermediate dates will have flexibility, but not the final completion date. There this will take an action of the discharger to prove to our Agency before a variance can be given. We have in many instances heard dischargers--Mr. Bryson has been at several of our meetings--where they will plead to us for a deviation in time and only in the final date. We will give flexibility in the interim date, and this does not necessarily constitute a variance under the terms of our statute. But at the time that we extend the final completion date, we must have a public hearing on this and in turn the Federal Government is informed as it indicates in our standards.

MR. STEIN: Any other comment or question?

MR. FRANGOS: I would just like to have a little bit to just get the facts here if I can get it right.

The outside compliance dates for meeting your requirements, in other words completion of construction, are 1973?

MR. BADALICH: Yes, that is right, Mr. Frangos, under our interstate water quality standards.

MR. FRANGOS: 1973?

MR. BADALICH: Right.

MR. FRANGOS: Now, you also anticipate between now and either this month or certainly by the end of this summer to have accomplished the State mechanisms, achieved the State mechanisms for getting stipulations or whatever other legal devices you need to pin this date down, is that correct?

MR. BADALICH: Yes. What we expect to do--I believe we have sent a letter to all of the industries and municipalities on the interstate system. And let me say at this time that we already have compliance, or in the program have compliance by approximately 70 percent of all of the dischargers on the interstate system.

Now, the balance of these 30 percent have been sent letters, and I believe the magic date is May 16 for them to enter into stipulation with the Agency. If they do not enter into a stipulation with us by this date of May 16, well, then we will immediately proceed with enforcement conference. We have the mechanism already set forth; the Agency has given me authority to proceed on an enforcement conference and I believe the date is scheduled for July 14.

MR. FRANGOS: Back to Superwood, and I don't know very much about Superwood, but the point is you have got a date that everyone has agreed to that goes to 1973, some almost 40 months from now, as I understand it. Now, are you suggesting, Mr. Mayo, that we need concurrence from the Federal agency for this 3-months period? In other words, there is no latitude for the State agency within that 3-months period to complete whatever it feels it has to do from a State regulatory capacity in a program to meet those outside deadlines? Is this what you are suggesting when you say no concurrence has been received?

MR. MAYO: Are you talking to me?

MR. FRANGOS: Yes, I was asking you.

MR. STEIN: Here, let me try this, because I think this kind of stuff doesn't lead very far. I noticed the applause when the Feds and the State went at each other, and I wish I had had a meter on that applause. I bet they were the polluters. (Laughter.)

But I want to tell you this--I have worked with John Badalich for a long time. Rather than my looking over his shoulder, and he may have trouble finding me when he needs me, but I'll tell you again, I am not going to devote my energy to scrapping with Badalich. He is not polluting any water. We are going to use that energy by my getting together with Badalich and getting after the people who are discharging wastes into our watercourses.

The issue that we have raised here is a technical and procedural one that we have to handle with some care. Obviously, it is a question of State-Federal relationship. I thought we said we were interested in that final date on an approval. The question of how you work the interim dates is, of course, a problem.

At the very minimum, though, I think that the Federal people should be informed as to when an interm date is extended, so they can make a judgment as to whether, in their opinion, the final date is going to be met.

Now, I have also asked that the Regional people in the administration of the Act set up interim dates themselves if they can't get interim dates from the State. It would be preferable to set this up with the State. Because, again, as you point out, Mr. Frangos, if we have to wait the whole 40 months before we can move, we may be wasting a lot of time. In other words, as the program progresses, I would say that within these 40 months, as the States do, we should make a judgment, or be able to make a judgment sometime along the line whether we are going to have to take further action or the dates are going to be met.

Just on the face of it, on the basis of what I heard in Mr. Badalich's report, it seems to me that Mr. Badalich is taking effective and direct action against every source under State law and that is what we have asked for. Not only his objective but his requirement is to meet the dates--the final dates that we both have agreed on.

MR. BADALICH: Right.

MR. STEIN: Right.

MR. BADALICH: And we have no objection to informing the Regional Office or Mr. Bryson's office on what these interim dates are. What I am saying is, if there is any possibility of any flexibility in this, I am certainly not going to wait for Federal approval for us to do this. But we have, as I say, established a final date, and this is the one that we will adhere to. And there will be no deviation from this, unless we go through the statutory procedure of a public hearing and notification to the Federal authorities, etc.

MR. MAYO: I have one more question on the phosphorus recommendation, Mr. Badalich.

You mentioned that with regard to certain of the industrial dischargers, the phosphorus content is likely to be either below 1 milligram per liter or present in insoluble or inert form. If there is no phosphorus removal required for these industries, will it still be possible for Minnesota to meet the basic commitment of the 80 percent reduction?

MR. BADALICH: Our effluent requirement, Mr. Mayo, indicates that we haven't established a limit. We indicated that all sources, irrespective of size or amount of discharge, have to lower their phosphorus level down to 1 milligram per liter. And our interstate water quality standards indicate that this applies to all discharges to lakes or reservoirs. We haven't at the present time, other than in the Lake Superior Basin, made this regulation effective on rivers and free-flowing streams.

But our requirement is 1 milligram per liter as the parameter to meet and not a percentage of removal.

MR. MAYO: How do you gauge the success, then, of the State in terms of meeting this requirement? I just would like this for general information.

MR. BADALICH: I think it would be more stringent.

MR. MAYO: O. K.

MR. STEIN: Are there any other comments or questions?

If not, thank you, Mr. Badalich, for an excellent report. I think everyone here can see the scope of the problem and where we are going. I do think Minnesota has to be commended here for its program, because I don't think there is any doubt--and I want the other States to listen to this--that the major problems in cleaning up sources in the Lake Superior Basin rest with Minnesota and are its primary responsibility.

Thank you.

Do you have anyone other than Reserve to go now?

MR. BADALICH: Mr. Chairman, you know, Reserve is one of the parties or participants for the State of Minnesota, and I would like them to make a presentation in some brevity on the proposal that they submitted, or the working draft of the progress report that they were required or requested by the Secretary to submit to the conference on April 1, after they submitted it to us on April 13, at our Agency meeting. I would like to call on Reserve, probably, right after lunch to make their presentation.

MR. STEIN: Well, here, let me indicate this. Some of the conferees have commitments on airplanes.

I will be here through the evening, but I would like to terminate this meeting certainly before 4 o'clock.

When do you have to get out, Mr. Purdy?

MR. PURDY: 4 o'clock.

MR. STEIN: So let us try to be here promptly at a quarter to 2 when we will start the afternoon session.

We stand recessed.

(NOON RECESS)

AFTERNOON SESSION

THURSDAY, APRIL 30, 1970

(1:45 o'clock)

MR. STEIN: Let's reconvene.

First we will call on Mr. Purdy.

MR. PURDY: Mr. Stein, Mr. Ralph Koenig presented a statement to me during the lunch hour, and on behalf of the UAW and Mr. Ralph Koenig I would like to insert this statement into the record.

MR. STEIN: Without objection, that will be entered into the record as if read.

(Which said statement follows:)

STATEMENT TO
LAKE SUPERIOR ENFORCEMENT CONFERENCE

My name is Ralph Koenig and I appear before this Conference on behalf of the UAW.

We would like to confine our remarks to the report and recommendations made by this Conference in its previous sessions. The report clearly points to the imminent dangers of the continued pollution of the waters of Lake Superior. That this lake, the largest of the Great Lakes and the largest fresh water lake in the world, should continue to be polluted by the distribution of Taconite tailings and other pollutants, in the name of progress, profit and business-as-usual, is sufficient cause for immediate remedial action by the Governments of the United States and Canada. Each of the recommendations is a distinct and specific condemnation of the polluters of this lake, its interstate waters and its tributary basin which includes the states of Minnesota, Wisconsin and Michigan.

We concur with the recommendations of the Executive Session, as stated in the summary of Conference of their first session. We note the May, 1970 deadlines in Points 6 and 7. We note the January, 1975, date in Point 8, by which time waste treatment is to be provided by municipalities to achieve at least 80 percent reduction of total Phosphorous from each state, or earlier, if required by Federal-State Water Quality Standards. It would seem that an earlier date than January, 1975, should be the goal of establishing adequate waste treatment for the municipalities involved for the simple reason that continued pollution between 1970 and 1975, even on an ever-diminishing scale, will serve only to further aggravate the polluted condition with which the recommendations are concerned. A prerequisite, of course, is enactment of Federal legislation immediately banning Phosphates from all detergents.

Point 9 of the recommendations allows four (4) years, until January 1974, for industries to provide compatible industrial wastes to municipal sewage systems. In the meantime, pollution will continue unabated, increasing the present dangers to Lake Superior, until such time as these industries see fit to change their present industrial wastes disposal systems. The obvious question is: "Can we afford to allow such extended time limits to the polluters of Lake Superior to correct their pollution of this Great Lake, when they have already done so much damage to this world's largest body of fresh water by their callous disregard of the public to whom this lake really belongs? We ask this question: "Shouldn't this time element be compressed into a much shorter period, in order to prevent the continued and unabated pollution of Lake Superior and the tremendous cost to citizens as has resulted in our belated attempts to restore Lake Erie?

Why must the polluting municipalities be allowed nine (9) years, as you have stipulated in Recommendation #13, to complete construction of separate sewers or other remedial action to prevent pollution of Lake Superior? How much pollution will occur between 1970 and 1979, when these pollution-contributing municipalities are expected to have corrected the conditions that demand immediate corrective actions? Can Lake Superior withstand the continuing and, in all probability, increasing, daily pollutions from each and all of these guilty municipalities?

If Lake Superior is so polluted today as to call for immediate remedial action by the several municipalities who contribute to such pollution, how much more polluted will Lake Superior be by 1979?

Recommendation #17 states that: "The dumping of polluted dredged material into Lake Superior be prohibited." We agree with this recommendation. But we ask: WHEN IS IT TO BE PROHIBITED? SHOULD IT NOT BE PROHIBITED TODAY? Can we afford to postpone the deadline for industrial and municipal pollution of Lake Superior into the future, regardless of the nearness of the date upon which we may suggest that pollution be stopped?

We share the same consternation about Recommendation #19. This recommendation states that: "The discharge of visible oil from any source be eliminated." The question is again: WHEN?

It is immediately apparent that the state pollution control agencies of the states of Minnesota, Wisconsin, and Michigan must have regulatory powers, supported by Secretary of the Interior, Walter J. Hickel, and all the agencies of the Federal Government whose jurisdiction, interest and concern is with the problems of water pollution of the Great Lakes and waterways whose existence is threatened by pollution of industry as is Lake Superior.

The UAW supports the Statement of Senator Gaylord Nelson, released April 29th, which urged this Conference to "...take strong and immediate action to halt Reserve Mining Company's pollution of the Lake with Taconite tailings (iron ore processing waste)." Federal evidence shows the tailings from the big mining company have spread over areas of a thousand square mile pollution of Lake Superior, including Wisconsin, as well as Minnesota waters. And in the telegram today to the Chief of the U. S. Army Corps of Engineers, the Wisconsin senator strongly reaffirmed his request of last fall that the Corps cancel its present permit allowing Reserve to dump its tailings--at the rate of 60,000 long tons a day--into Lake Superior. Any future permit, Nelson told the Corps, should be based on the adoption of a plan that guarantees "The expeditious and complete elimination of the tailings' pollution of the lake."

Just as we oppose the dumping of tailings into Lake Superior, we will also vigorously oppose the destruction of any wild life habitat which may be contemplated as a dumping ground for the Taconite tailings.

The UAW's concern may be best presented to you by an excerpt from the eulogy at Earth Day ceremonies on the Detroit River, jointly sponsored by the following participants: UAW Downriver Anti-Pollution League; Michigan Citizens Against Pollution; and Pollution Probe of Ontario, Canada:

EARTH DAY EULOGY

"As we gather to plant a wreath upon our dying river and to exchange resolutions with our Canadian brothers, we are participating in an act of protest and prayer.

In this act, we symbolize our anger at the unchecked and unmodified tools of production which pollute our environment. It has taken scarcely 150 years for our technology to ruin what it took nature millions of years to produce. We symbolize our horror at the effect of pollution: unbreathable air, undrinkable water, the disappearance of land and water life, the invasion of our bodies by untested drugs, and tree removal.

We symbolize our frustration at the slow response of government and industry to these problems. And we symbolize our sadness that we must work at jobs and live in communities which contribute to the problem daily."

The Wisdom of the Ages has taught us that man cannot destroy his habitat and survive. Apparently we have not learned, for we litter--we pollute. We, in effect, use our blessings with a vengeance.

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MR. STEIN: Continue with the Minnesota presentation, Mr. Badalich.

MR. BADALICH: Yes, Mr. Chairman. I do have a late request from Dr. Charles Huver of the University of Minnesota, who would like to make a statement later on this afternoon.

Other than that, we conclude our presentation, other than Reserve Mining.

MR. STEIN: All right.

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: I would like to call on Mr. Ed Fride, attorney for the Reserve Mining Company, who will introduce the other witnesses and make a presentation for Reserve Mining Company.

Mr. Fride.

EDWARD T. FRIDE
ATTORNEY AT LAW
DULUTH, MINNESOTA

MR. FRIDE: Mr. Chairman.

MR. STEIN: Yes. May we have quiet, please.

Mr. Fride.

MR. FRIDE: Mr. Chairman, conferees, ladies and gentlemen.

My name is Edward Fride. I practice law here in Duluth and I appear on behalf of Reserve Mining Company.

In the interest of the conferees' time, Mr. Chairman, I have filed with the Minnesota conferee a statement of Reserve Mining Company, an engineering task force progress report, and a bottom fauna report, which I would ask be part of the record without reading the same in full.

MR. STEIN: Without objection, all these items will appear in the record as if read.

(Which said statement and reports follow:)

STATEMENT OF RESERVE MINING COMPANY TO
RECONVENED SESSION OF LAKE SUPERIOR CONFERENCE
April 29 and 30, 1970 in Duluth, Minnesota

The Lake Superior Conference in Duluth, on May 13, 14 and 15, 1969 resulted in a transcript of some 856 pages of testimony and in addition numerous papers and exhibits were submitted to the Conferees. Reserve Mining Company appeared during those proceedings and submitted evidence by nine witnesses, including nationally renowned scientists, that the Company's discharge of the waste sand known as taconite tailings had no adverse effect on any beneficial use of Lake Superior. Reliance is placed on those statements and the supporting data submitted with them. A brief digest of those statements is appended as Attachment 1.

An "executive session" of the Conference was held on September 30-October 1, 1969 in Duluth, for the announced purpose of analyzing the record made at the May Conference. It was made clear that no new evidence or testimony would be submitted but nevertheless new information was presented by representatives of the FWPCA and no opportunity was afforded Reserve Mining Company to respond to or refute certain of their statements. Reserve's earlier comments with respect to the "executive session" are appended as Attachment 2.

On January 26, 1970 Secretary of Interior Hickel issued his Summary of Conference. The Recommendations made included the following:

> "2. The FWPCA and the States keep the discharge of taconite tailings to Lake Superior from the Reserve Mining Company, E. W. Davis Works, under continuing surveillance and report to the conferees at six month intervals on any findings that interstate pollution is occurring or is likely to occur."
>
> "3. Reserve Mining Company be requested to undertake further engineering and economic studies relating to possible ways and means of reducing by the maximum practicable extent the discharge of tailings to Lake Superior and submit a report on progress to the Minnesota Pollution Control Agency and the conferees within six months of the date of issuance of the Summary of Conference by the Secretary of the Interior. This report is to include a tentative timetable for necessary action. Lake sampling and effluent and operational information shall be furnished monthly by the Reserve Mining Company to the Minnesota Pollution Control Agency. Reserve Mining Company also is to inform the Minnesota Pollution Control Agency of the line of study they intend to pursue, and the Minnesota Agency will make this information available to the conferees."

Thus, the Summary requests "* * * a report on progress to the Minnesota Pollution Control Agency and the conferees" by July 26, 1970.

Prior to the issuance of the Secretary's Summary, Reserve announced the formation of an engineering task force to consider possible methods of altering or modifying the discharge of tailings into the Lake from the viewpoint of sound conservation practice, technical feasibility, and economic feasibility.

Consistent with that announcement, the Secretary's Recommendations, the Company's long established policy of cooperation with appropriate governmental agencies and without waiving any legal rights, the Company and its consultants are making an intensive investigation of possible modifications or alterations.

The Minnesota Conferees supplied Reserve with a copy of Secretary Hickel's letter of January 26, 1970 wherein he stated:

> "* * * I recommend that a working copy of the progress report be ready by April 1, 1970, and that the final progress report be prepared as recommended '* * * within six months of the date of issuance of the Summary of Conference by the Secretary of the Interior'".

In that letter the Secretary also states that he has

> "* * * confidence that a meaningful working copy of the progress report can be completed before April 1, 1970."

In accordance with that recommendation, Reserve supplied the staff of the Minnesota Pollution Control Agency a working copy of its Progress Report prior to April 1. Reserve was requested to formally present the working copy of its Progress Report to the Minnesota Pollution Control Agency at its regularly scheduled meeting on April 13, 1970 and it did so. The Company has also submitted to the Minnesota Conferees for transmittal to the Federal, Michigan and Wisconsin Conferees, such working copy of its Progress Report. Reserve anticipates at the reconvened session an opportunity to formally present the working copy of the Progress Report and to respond to any of the Conferees' questions concerning the same.

The Federal Statute under which the Conference was convened provides in part that a Court in reviewing the recommendations of the Conference and any subsequent proceeding should give

> "* * * due consideration to the practicability and to the physical and economic feasibility of securing abatement of any pollution proved, shall have jurisdiction to enter such judgment, and orders enforcing such judgment, as the public interest and the equities of the case may require."
> (33 USCA 466 g (h))

Long before the convening of the Conference, Reserve supplied the Minnesota Pollution Control Agency with detailed information from its comprehensive Lake studies' program. It has complied with the Secretary's recommendation that "lake sampling and effluent and operational information shall be furnished monthly by the Reserve Mining Company to the Minnesota Pollution Control Agency." Emphasis is placed on the fact that, as revealed in those reports and in data presented to this Conference, extensive surveillance and monitoring of Lake Superior during the 14 years of Reserve's operations reveals no realistic basis for any conclusion that any harm is being occasioned to any beneficial use of the Lake by Reserve's discharge. Affirmatively, tests by Reserve, as well as local, State and Federal governmental agencies, disclose no significant change in the water quality of Lake Superior before and since the Company's operation.

Reserve is advised that certain "Reports of Technical studies for the Lake Superior Enforcement Conference" were submitted by certain personnel of the National Water Quality Laboratory in Duluth to the Conferees. These reports were not made available to Reserve until April 21, 1970. Obviously the time interval between the receipt of such reports and the reconvening of the Conference is not sufficient to permit detailed analysis of the data presented and particularly a comparison between such data, other existing data from various sources and the opinions expressed. Reserve requests the Conferees to afford it an opportunity to present such an analysis within a reasonable time to be fixed by the Conferees.

Within the short time span described, however, certain observations can be made. In a number of respects the new "Reports" confirm statements made on behalf of Reserve at the

May session. For example, personnel of the National Water Quality Laboratory now report that they have found cummingtonite in many Minnesota and Wisconsin streams thus confirming Reserve's earlier testimony that when cummingtonite is detected in Lake Superior its source may be other than tailings.

Such personnel again acknowledges that "green water" is also caused by sediments other than taconite tailings. There is no disagreement reflected about the fact that the "green" in green water is not a true color but only an apparent color. Such apparent color has no significant effect on water quality.

Some previous statements made to the Conferees were to the effect that Reserve's discharge may violate certain water quality criteria--copper, zinc and other metallic elements normally considered to be harmful pollutants at certain concentrations. Dr. Glass' report concludes that the minute amounts of certain trace metals in the tailings--specifying copper, zinc, cadium, sodium and iron--do not go into solution. This confirms Reserve's own data on the subject and leaves the earlier statements of such alleged violations unsupported.

The basis for the statement of a "deleterious effect" of tailings which was included in the Secretary's Summary was apparently premised on a State of Minnesota Conservation Department Report that did not support such a conclusion. This dealt with an alleged effect of tailings on certain bottom fauna. Reserve's technicians have secured hundreds of bottom samples and have classified and counted all available species of bottom fauna, at varying depths over a wide area of the Lake. This data, far greater than that collected by State or Federal Agencies, certainly does not support any conclusion that tailings have had any adverse effect upon bottom fauna. The new "Technical Reports" do not provide any further information on bottom fauna, nor do they repeat the earlier conclusion. Accordingly, it would appear that the conclusion of "deleterious effect" remains unsupported.

As reflected in the Secretary's Summary and the Secretary's letter of January 26, 1970, Reserve was advised that the focus of that portion of the Conferees' deliberations which relate to Reserve would involve the presentation of a "working copy of its Progress Report" of "engineering and economic studies relating to possible ways and means of reducing by the maximum practicable extent the discharge of tailings to Lake Superior." In conformity therewith Reserve's presentation will be substantially devoted to an explanation of the studies to date and response to related inquiries by the Conferees. Those reports which have previously been submitted to the Conferees should be considered a part of this statement.

Mr. Kenneth Haley, Vice President and Manager of Research and Development for Reserve Mining Company, and Chairman of the Engineering Task Force, will present the working copy of the Progress Report to the Conferees. Mr. Haley is a graduate of Ohio State University in Metallurgical Engineering, has been associated with taconite processing since 1948, and has been employed by Reserve Mining Company continuously since 1952.

Inasmuch as the recent "Technical Reports" have been submitted to the Conferees, Reserve takes this opportunity of making some brief, preliminary comments relating to them for the consideration of the Conferees which comments are appended as Attachment 3.

Consideration should be given to the statement of Dr. Mount at the "Executive Session" of the Conference. He testified:

> "* * * I think we have a tendency at times to close our eyes to the multiple use concept of water as well, and I don't really think that we want a distilled water basin in Lake Superior either. We have to have some phosphorus in the water in order to provide nutrients for the necessary amount of algal growth that must take place in the lake in order to sustain a commercial fish crop. * * * The point I am making is that our goal is not zero phosphorus but some appropriate value which will permit sufficient plant growth and still maintain the esthetic appearance of the lake. And we believe that this value lies somewhere between what it is now and 0.01. I don't know whether I have clarified the issue at

> "all or not, but what I am trying to say is there is a tendency to think that anything in this water is bad beyond H_2O and this is clearly not the case. As a matter of fact, many of the parameters that are listed in this table are very necessary for growth and were they not there we would not have a desirable condition either. * *.*." (pp. 118, 119 of transcript)

Reserve believes that a fair and realistic appraisal of all of the data submitted to the Conferees in connection with taconite tailings compels the conclusion that they are not having any material or significant effect on the water quality of Lake Superior nor on any beneficial use of that Lake.

Reserve suggests that all parties--and especially the public--would be better served if Reserve, the Minnesota Pollution Control Agency, and the Federal Water Quality Administration, would, in the future (a) standardize, to the maximum extent practicable, the equipment, techniques and methodology employed in water quality sampling and analyses, (b) agree to exchange of data and information, and (c) freely discuss the data in an attempt to arrive at scientifically acceptable findings and evaluations.

Reserve has pledged to explore possible alterations or modifications in its discharge and has provided the Conferees with the working copy of the progress made to date by eminently qualified engineers. In good faith Reserve will carry out its announced policy and report further progress of these studies to the Conferees.

Respectfully submitted,

Edward T. Fride
Attorney for Reserve Mining
Company
1200 Alworth Building
Duluth, Minnesota

June 6, 1969

DIGEST OF STATEMENTS PRESENTED BY
RESERVE MINING COMPANY
TO THE CONFERENCE ON POLLUTION OF THE INTERSTATE WATERS OF THE LAKE SUPERIOR BASIN

HOTEL DULUTH
DULUTH, MINNESOTA
MAY 13, 14, 15, 1969

EDWARD M. FURNESS
President
Reserve Mining Company

Mr. Furness said Reserve's continuing lake studies over the years, as well as scientific data gathered by others, show there has been no adverse effect on Lake Superior by the tailings (sand) discharged at Silver Bay. He said he knows of no way Reserve's operations will endanger the lake's water, fish or aquatic life, or the water supplies of any communities bordering the lake. He said expert scientific witnesses would appear later in the conference to present data to support Reserve's position that tailings do not have a "deleterious effect on the ecology of a portion of the lake" as charged by the Federal Water Pollution Control Administration (FWPCA).

He described the processing of taconite and explained why it was necessary for Reserve to locate its concentrating plant on the shore of Lake Superior instead of near the taconite mine at Babbitt--inadequate water supply and the absence of a low-lying area large enough to serve as a tailings basin in the Babbitt area.

Mr. Furness pointed out that when the waste sand is discharged onto the beach at Silver Bay, about 45% of the total is coarse and heavy enough to settle on the beach, never reaching the lake. The balance of the tailings are fine enough to be carried by the discharge water over the beach to the lake itself. Because this tailings-laden water is heavier than the lake water, it flows down to the bottom of the lake, seeking the lowest level. The solids settle out of this heavy density current when it loses its momentum in the 600 to 900-foot deep Great Trough located near and parallel to the Minnesota shore of the lake.

(Attachment 1)

He also stated that the mineral cummingtonite --common in tailings--can have no harmful effect whatever on water for human consumption. The FWPCA, using cummingtonite as a tailings identifier, suggested tailings may be present in the water supplies of several lakeshore communities. Cummingtonite, alone, Mr. Furness said, is not a valid indicator of tailings since the mineral enters the lake from sources other than Reserve.

Mr. Furness stated there is no evidence that Reserve is violating state and federal permits. Documented evidence was introduced later in the conference to prove that the company is in compliance with all the terms of its permits. He cited studies by several Interior Department agencies showing no evidence of harm to fish from tailings. Mr. Furness explained that Reserve, in its continuing water quality program, has studied Lake Superior's biota, chemistry, mineralogy, currents, turbidity, temperature, color, bottom characteristics and contours. He said the knowledge and skills of "our own technical personnel have been augmented by consultants--nationally renowned, recognized experts in their respective fields" who would testify later.

He also summarized the history and development of Reserve's taconite operation and its importance to the economy of the state and region. Reserve, he said, employs more than 3,200 people, has a capital investment of $350 million. Its state and local tax bill amounts to about $4 million annually.

EDWARD SCHMID
Assistant to the President
Reserve Mining Company

Mr. Schmid's testimony concerned the so-called "green water" phenomenon and a detailed explanation of the heavy density current which carries the tailings along the bottom lake contours to the 600 to 900-foot deep trough in front of Silver Bay. He said tailings are not responsible for areas of "green water" which he described as an age-old phenomenon studied by scientists for years in Lake Superior and other bodies of water. If "green water" were caused solely or mostly by tailings, he said, it would be seen constantly near Silver Bay. It is not. He quoted the FWPCA report as saying that "Green water was observed along the Wisconsin shoreline and did not contain tailings." Several U. S. agencies which conducted studies of the lake reported that "green water" sometimes was apparent, sometimes it was not. Mr. Schmid showed color aerial slides of "green water" in Lake Superior taken before Reserve began operations and also of "green water" in Lake Michigan. He quoted recent federal studies saying there is little difference in the amount of suspended solids in "green water" and so-called "clear" or "blue" water. He said temperature differences can cause changes in light refraction giving what appears to be a different color to the water from that of colder water farther out in the lake. He emphasized that water which looks green in the lake is not green in a sampler and a glassful appears colorless to the naked eye. When subjected to prescribed color tests, he said, it is colorless.

Mr. Schmid also showed color movies to illustrate the action of heavy density currents in laboratory tests and in actual operation off Reserve's tailings beach and several North Shore rivers. Tailings--inert and insoluble sands which are biologically inactive in Lake Superior--flow by density current to great depths of the lake where they settle out and remain.

EARL H. RUBLE
Duluth, Minnesota, Chemical and Sanitary Engineer and former Public Health Engineer for U. S. Public Health Service, City of Duluth and State of Minnesota, and consultant for water treatment to Duluth, Two Harbors, Grand Marais and Beaver Bay, Minnesota

Mr. Ruble emphasized that his studies of Lake Superior, which span more than 30 years, show that Reserve's tailings do not in any way violate present stringent federal-state water quality standards. He said Reserve is not adding anything to the lake which will impair the quality of the water or endanger human or marine life. From his own studies conducted independently of Reserve, he reported that the company's operations have had no effect on Lake Superior.

He said natural sediments on the bottom of the lake contain greater concentrations of most trace metals than do Reserve's tailings. No harmful effect has resulted, he said, and none is anticipated. He reported that he observed and studied areas of "green water" on many occasions before Reserve ever began operations. "It is simply wrong to conclude that Reserve is responsible for the phenomenon," he said. As for turbidity, he testified that Reserve's operations have had no effect on Lake Superior.

DR. G. FRED LEE
Professor of Water Chemistry and Director of Water Chemistry Program at University of Wisconsin, Madison, Wisconsin

Dr. Lee testified that water chemistry studies show that elements present in taconite tailings do not enter into solution and, therefore, are probably non-toxic to aquatic organisms, and would not be expected to have any detrimental effect on drinking water or other beneficial uses of the lake.

He said FWPCA has made statements of fact which are, in reality, merely opinions not supported by experimental facts. He criticized proposed FWPCA Lake Superior criteria as being unrealistic since the lake itself has, for many years, exceeded these criteria. To demonstrate further that FWPCA's proposed criteria are unrealistic, he said the Brule River in Wisconsin, which empties into Lake Superior, contains copper in quantities which greatly exceed the FWPCA proposed criteria for this element. Yet, he said, the Brule is a renowned trout stream fished annually by people from throughout the country.

Dr. Lee said he has reviewed all of Reserve's analytical chemistry capabilities and its analysis of tailings, Lake Superior water and sediments, and the company's research program. He said "Reserve is conducting analyses with the best available analytical chemistry techniques and has taken all reasonable steps to insure that these analytical procedures yield precise and accurate results." These studies confirm earlier government studies which established that Reserve's waste sands are not harmful to the lake.

DR. ROBERT C. BRIGHT Associate Professor of Geology and Ecology, University of Minnesota Limnological Research Center, Minneapolis, Minnesota	A prominent ecologist and biologist, Dr. Bright testified that tailings do not affect the fish food chain in Lake Superior. He criticized the FWPCA report which claimed that cummingtonite, found in the water supplies of several lakeshore communities, is a valid indicator of taconite tailings. Dr. Bright said cummingtonite has been found in several North Shore streams which empty into the lake. Where this material is fine enough, he said, it is suspended in the lake and x-ray analysis of the suspended load indicates cummingtonite. It is, therefore, possible that the material could be wrongly identified as tailings from Reserve's discharge. He also testified that the standing crop of algae in the lake is remarkably homogeneous which indicates a monotonous environment and that the algae were completely unaffected by addition of tailings into the lake. Dr. Bright's evaluation of Reserve's limnological research program: "The most comprehensive data available for Lake Superior and it is extremely reliable."
DR. ROBERT A. RAGOTZKIE Professor, Department of Meteorology and Director, Marine Studies Center, University of Wisconsin, Madison, Wisconsin	Dr. Ragotzkie, a nationally-known authority on currents in general and Lake Superior currents in particular, said that "beyond a doubt" a density current transports tailings into the 600 to 900-foot deep trough in front of Silver Bay where the material settles and stays. He said the stability of water stratification, resulting from temperature factors, isolates the material physically and chemically, from further recirculation into surface waters. In effect, Dr. Ragotzkie refuted claims that Reserve's tailings are escaping from the deep trough and circulating about the lake into Wisconsin and Michigan waters. Ragotzkie said data from studies by federal and Reserve scientists and consultants prove "beyond a doubt that density currents exist and that they are operating effectively to transport the taconite tailings into the deep trough adjacent to the Silver Bay shoreline. Once the tailings are transported below the thermocline, the stability of the water stratification will tend to isolate the material from further recirculation into the surface waters. This isolation certainly exists during the summer and winter stratification and may also prevail during the brief periods when the lake is isothermal" (relatively uniform temperature).

JAMES K. RICE President, Cyrus Wm. Rice and Company, Water Management Consultants. Mr. Rice, a chemical engineer, was chosen in 1967 by former Interior Secretary Stewart L. Udall to be chairman of the Committee for Industrial Water Supplies when Udall established the first National Technical Advisory Committee on Water Quality Criteria to the FWPCA. Mr. Rice has served on many government and industry study groups and is recognized as a pioneer in the development of many modern methods of industrial water conservation and re-use.	Mr. Rice testified that examination of all data, including that of federal agencies, shows that there is no evidence that taconite tailings discharged have any significant effect on the quality of Lake Superior's water. He said his firm's studies and analysis of all data presented to date by governmental agencies and by Reserve show that the tailings form a heavy density current and flow along the bottom down the natural slope. He also said his analyses showed that copper, zinc and lead were lower in the tailings area of the bottom than in the lake as a whole.
KENNETH M. HALEY Vice President and Manager, Research and Development Division, Reserve Mining Company	Mr. Haley, testifying on Reserve's continuing extensive lake studies program, said he knows of no evidence to support charges that Reserve's tailings are having or will have any harmful effect on Lake Superior. Using a three dimensional scale model of the bottom contours of the western 20 per cent of Lake Superior, Mr. Haley indicated the 966-foot deep trough where the finer portion of the tailings settle, and the areas where tailings have been found through bottom sampling. After 13 years of operations, the tailings are only about seven inches thick on the lake bottom in the 600 to 900-foot deep trough. Even after 50 more years of operations, the thickness of the tailings layer, at this rate, would only be about three feet at those depths. He also refuted claims that the company's operations are producing finer tailings than was originally planned. Screen analyses show today's tailings are essentially the same size, or coarser. Mr. Haley reported that more than 3,000 chemical analyses of water samples show that "tailings have no effect on the chemical or biotic analyses of

Lake Superior water." He cited data from a recent Minnesota Department of Conservation study to show that the total amount of fish food organisms on the lake bottom near Silver Bay has no relation to the presence or absence of tailings. Similarly, a study by the U. S. Bureau of Commercial Fisheries states, "No evidence is available to indicate that any fish population has been adversely affected by tailings."

He pointed out that chemical analyses show that heavy metals considered objectionable by the FWPCA are very low in Reserve's tailings--much lower than in the natural sediments.

As for the presence of cummingtonite in several community water supplies, Mr. Haley emphasized that cummingtonite is harmless to humans. Cummingtonite sand is a species of mineral belonging to the silicate class, as is quartz sand that is used for the sand of water filter beds in modern water treatment plants. Cummingtonite could also be used as a filter material. Cummingtonite, alone, he said, is not a valid indicator of tailings--that any analyses for the presence of tailings should consider several other important factors such as a low concentration of titanium, copper and several other elements. He said that merely because cummingtonite has been found in water supplies of several lakeside communities, there is no reason to assume that the source is Reserve's Silver Bay plant. He pointed out that Reserve gives tailings to many state, county and local governments for use in road sanding, maintenance and construction. This, he said, could well be the source of cummingtonite as well as the several North Shore streams in which the mineral has been detected.

Mr. Haley also made the following points: Reserve's operations have caused no significant change in the lake's pH, dissolved oxygen, temperature, dissolved or suspended solids; the lake water in the Silver Bay area is cleaner than water in other areas of the lake--including Wisconsin--by FWPCA data, as well as tests by Reserve and the Wisconsin Department of Natural Resources; none of the chemical analyses reported as soluble exceeded stringent Minnesota water quality standards; no total copper, cadmium or zinc analytical results exceeded state water quality standards.

STIG FORSSMARK
President, Trygve Hoff & Associates, Engineering Consultants, Cleveland, Ohio

Summarized detailed engineering study made by Trygve Hoff of the so-called alternate proposal for disposing of tailings in a diked impoundment area high in the hills back of Silver Bay and Beaver Bay. The proposal would make it impossible for Reserve to operate more than 22 years and would be fantastically expensive, requiring the capital expenditure of more than $250 million. That cost estimate, he said, does not include such items as land acquisition, financing, lighting, communications, roads, distribution pumping and other vital elements. He referred to a recent report by the U. S. Bureau of Mines which pointed up several objections to such a proposal. The Bureau stated that objectionable effects of a tailings pond on high ground would have to be carefully weighed against the effects, if any, of depositing tailings in Lake Superior.

The alternate plan, Mr. Forssmark said, would destroy private and state property in the entire drainage area. The proposed site is 800 feet above the present tailings delta. The suggested plan would create staggering engineering problems including a series of dikes, or dams, two of which would probably be among the largest rock dams in the world. One would be about 250 feet high and more than a mile long; another would be 200 feet high and more than two miles long. The new facilities would include ten pipelines, ten pumping stations, the dike system, three huge concrete thickeners on the present delta, and facilities to grind the coarse tails to permit pumping in a slurry. The flow of the east branch of the Beaver River would be drastically reduced. During periods of heavy rain, excess water carrying the finest tailings would have to be drawn out of the basin into the river which flows into Lake Superior.

The proposal is neither feasible nor practical and would create--not solve--conservation problems.

STATEMENT OF RESERVE MINING COMPANY Relative to the Deposit of the Tailings From Its Silver Bay Taconite Plant, Dated April 1, 1969

In addition to the testimony of the witnesses above and the statements submitted by them, Reserve submitted a written statement outlining in detail the procedure followed and the public hearings held in connection with the granting of permits to Reserve by state and federal authorities in 1947-1948, and in subsequent hearings amending those permits. Among other things, this statement points out that the hearings conducted by the state and federal authorities were very extensive and that most of the questions that are being raised now were considered then, and answered by experts on the subjects. This statement contained information as to each of the "trace metals" referred to in the hearings, and pointed out that natural bottom sediments deposited in the lake by rivers and streams over thousands of years contained substantially the same trace metals without harmful effect on the lake.

RESERVE RESERVE MINING COMPANY
SILVER BAY, MINNESOTA 55614

November 17, 1969

INTRODUCTION

The Federal-State Enforcement Conference held on May 13, 14, and 15, in Duluth resulted in a transcript of some 856 pages of testimony, and in addition numerous papers and exhibits were submitted to the conferees. At the conclusion of this conference, the Federal Commissioner presiding stated:

> "We will, therefore, stand in recess for about a month to examine this material. Following that examination the conferees will be called together for an executive session where we will develop a conference summary as required by law." (Page 855 of the transcript.)

In the public notice released on September 8, 1969, by the Department of the Interior, it was specifically stated that the conferees would meet in executive session. The notice stated that the "public will be permitted to observe the proceedings," but it was made clear that no new evidence would be heard.

Notwithstanding the statements that the executive session would be only for the purpose of analyzing the record made at the May Conference, there was substantial new testimony offered by the FWPCA only, and apparently accepted by the conferees. No opportunity was given Reserve to rebut that testimony or to supply additional data or information. The FWPCA representatives presented testimony from six witnesses, all associated with that organization. That they were offering new testimony was made clear by the following statement of one of the witnesses:

> "At this point before I go any further, I would like to ask the conferees for questions, since I realize this is a totally new presentation to you and this conference, as I understand, is to clear up questions of the record." (Executive session transcript, page 27; emphasis supplied.)

Attachment 2

Some of these witnesses even admitted that much of their testimony was speculation and that much additional evidence and testing of many additional samples would be needed. In fact, one of the witnesses testifying with respect to bottom cores, said:

> "Well, as I mentioned earlier, the detailed analysis of the cores has been completed on approximately half of the cores, and we estimate another month and a half to two months to finish the other half." (Executive transcript, page 43.)

In response to questions from the chairman, another FWPCA witness commented:

> "But what it represents in the total picture as circulation within the lake, and so forth, it would be pure speculation at this time." (Executive session transcript, page 38; emphasis supplied.)

An FWPCA biologist acknowledged that he had not performed any bottom surveys and had relied solely on studies made by the State and by Reserve Mining Company. As we will point out in the section dealing with that subject, these studies do not support in any way the conclusions reached by these witnesses.

Reflecting the concern of the State conferees that the procedures adopted at this intended "executive session" precluded the opportunity for rebuttal of the new testimony offered by the FWPCA and time for analysis of that testimony, the Minnesota conferee made this statement:

> "* * * We are going under the pretense that we would evaluate the data as presented, and I think this morning we were given a lot of additional data, new testimony, I still maintain it is new testimony, and I certainly would like to have time to evaluate this information with my experts and also with possibly some of the consultants, I am referring to the Conservation Department and others in State government that have the expertise to make an evaluation.
>
> "So I am not prepared to make any rebuttal of any of this information, but we certainly would like to have time to study it and probably come up with some conclusions or recommendations of our own based upon the testimony brought forth this morning." (Executive session transcript, pages 120 and 121.)

The Michigan conferee said:

> "I came on the basis of this being an Executive Session. No presentation to make on behalf of Michigan." (Executive session transcript, pages 163-164.)

The lack of fairness to Reserve in singling it out, presenting new testimony at an "Executive Session" with no opportunity to comment or rebut, and then exerting pressure on the conferees to come up with immediate conclusions is obvious.

Reserve has reviewed the transcript and takes this means of submitting to the conferees some comments thereon. No attempt is made to restate the extensive data submitted by Reserve and its independent consultants at the May Conference.

SECTION I.

THERE IS NO SUPPORT FOR THE CHARGE THAT TACONITE TAILINGS HAVE HARMED WISCONSIN WATERS OF LAKE SUPERIOR

Representatives of the FWPCA stated that the mineral cummingtonite was a valid indicator of taconite tailings discharged by Reserve into Lake Superior and that tailings (identified by the presence of cummingtonite) were found in bottom sediments on the Wisconsin side of the dividing line in Lake Superior. This has led many persons to the erroneous conclusion that Reserve is guilty of interstate pollution--a charge not made by the representatives of the National Water Quality Laboratory.

FWPCA obtained sixteen samples from Wisconsin bottom areas. Eight of them contained cummingtonite intermixed with natural sediments on the bottom at depths of several hundred feet, according to the testimony. Based on this, the FWPCA representatives expressed the opinion that tailings from Reserve's operations had been carried by the prevailing surface currents down the lake toward Duluth and then up the Wisconsin side of the lake where they settled out.

Reserve does not agree that cummingtonite--by itself--is a reliable identifier of Reserve's tailings. Cummingtonite--which is not a polluting substance--is a common mineral found all over the world. It is very much like quartz, commonly used in modern water treatment plants to filter water for drinking and other domestic uses.

Cummingtonite constitutes slightly less than half of Reserve's tailings, most of the remainder being quartz. Without question, if a sample contains no cummingtonite, it cannot be Reserve's tailings, since that mineral constitutes such a large proportion of those tailings. But the presence of cummingtonite--by itself--is not positive evidence of tailings from Reserve's discharge, since there are other sources of cummingtonite in the Superior drainage basin. It is an indication that a sample may contain tailings. Further tests are necessary to make a more positive identification.

Reserve has found sources of cummingtonite in Lake Superior other than tailings from Reserve's discharge. The mineral exists in the taconite deposits of the east end of the Mesabi Range in Minnesota--the source of Reserve's taconite. Scientists Gunderson and Schwartz in their book, "The Geology of the Metamorphosed Biwabik Iron Formation, Eastern Mesabi District," say the cummingtonite from the area where Reserve's tailings originate is similar to that found in the Michigan iron formation.

Also, more significantly, it occurs in the westerly or Wisconsin end of the Gogebic iron formation. One specific location where anyone can find cummingtonite is about eight miles west of Mellon, Wisconsin, near the Mineral Lake fire tower. Some of Wisconsin's streams flow across the outcrop of this formation into Lake Superior.

There are, undoubtedly, other sources of cummingtonite in the lake. For instance, representatives of the FWPCA stated that Reserve's tailings (identified only by cummingtonite) are carried by the prevailing counterclockwise (northeast to southwest) current along the North Shore of the lake from the Silver Bay area toward Duluth. Yet they reported finding cummingtonite in the municipal water supplies of Grand Marais and Grand Portage. These communities are approximately 50 and 90 miles, respectively, northeast of Silver Bay. Obviously, there can be no connection between the cummingtonite in those areas and Reserve's discharge.

The detection of cummingtonite in the waters of streams entering Lake Superior is somewhat erratic; the stream sediments vary at times of high and low water, as well as in periods of changes in the erosion of the drainage basin and beds of the streams. Because of this, Reserve has found it necessary to sample streams a number of times--not just once. Reserve has found cummingtonite in the Iron River of Wisconsin--a stream which enters an area of the lake from which bottom samples containing cummingtonite were obtained by Federal personnel. On other occasions, samples from that stream did not show cummingtonite. The same is true of Minnesota streams entering Lake Superior which sometimes carry cummingtonite and at other times do not.

Another source of cummingtonite in Lake Superior is the taconite tailings which Reserve gives to the state and county highway departments for use in construction, repair and sanding of highways along the North Shore of Lake Superior. Samples of roadside gravel from Duluth to Grand Portage contain high concentrations of cummingtonite.

Reserve points out these facts to explain why the presence of cummingtonite is not--by itself--sound evidence that the material found in the eight bottom samples from the Wisconsin side of the center line of Lake Superior constituted tailings from Reserve's operations.

Moreover, even if some of those samples did contain tailings, the quantities are so insignificant that they could not in any way endanger anyone's health or welfare. This is obvious from examination of the actual testimony of the FWPCA personnel. They testified that the layer of bottom sediments containing cummingtonite on the Wisconsin side of the lake was only two to three millimeters (about 1/8-inch) thick. These bottom samples were taken by the FWPCA in waters estimated to be 200 to 600 feet deep. They contained 1% to 10% cummingtonite which indicates the possibility of a maximum of 20% tailings; the remaining 80% of this 1/8-inch layer being natural sediments. In all cases, the cummingtonite and the natural sediments were intermixed.

For instance, on this point, one of the FWPCA witnesses testified with respect to a sample from the Wisconsin side as follows:

> "* * * This particular cummingtonite peak, by the way, would probably represent one or two per cent cummingtonite or taconite tailings, they are defined by, in the surface, the two millimeter (approximately 1/8-inch) depth in that particular core. In other words, the taconite tailings in circulating through the current pattern through the western basin of the lake and reaching this particular deposition spot have been grossly diluted, dispersed and mixed with clay minerals from the South Shore streams. The layer as such is not 100 per cent tailings by any stretch of the imagination, but it is mixed with the natural sediments. * * *"

In other words, if the identification were correct, the tailings deposited in those areas during 13 years of Reserve's operations were about the thickness of a sheet of paper, mixed with much more of the natural sediment. How could so little have any significant effect?

The finding of cummingtonite in bottom samples taken from the Wisconsin side of the lake demonstrates that materials finer than two microns in size do not remain in suspension indefinitely--they settle on the bottom of the lake. The FWPCA stated that they found particles that size in those bottom samples.

The impression given the public by some news stories based on this evidence is that the Federal-State Conference reached a definite conclusion that the discharge from Reserve's operation endangered the health or welfare of persons in Wisconsin and Michigan. Actually, the conclusion referred to--which was proposed by the conferee from the State of Michigan and concurred in by the other conferees--was only that there was "presumptive evidence" in the record to indicate that there might be pollution. The Michigan conferee explained the finding by saying (page 161 of transcript):

> "MR. PURDY: What I mean by presumptive evidence is that, as I understand it, there will be continuing, there will be continuing analytical work on samples already collected, and that this may at some later point in time--or that this at some later point in time should be reviewed by the conferees to make a determination whether there is such a pollution occurring or whether there is not such a pollution occurring."

When this conclusion and the supporting evidence are analyzed, there is no basis whatever for the inferences which have been drawn that there is definite evidence of any pollution of these waters.

SECTION II.

ARE LARGE QUANTITIES OF THE TAILINGS UNACCOUNTED FOR?

The FWPCA, in trying to account for all the tailings ever discharged by Reserve, stated that they could not account for about 65, 000, 000 long tons. They used Reserve's data as interpreted by the U. S. Geological Survey. They advanced the theory that since that tonnage appeared to be "missing," the tailings had gone into solution or were suspended in the lake water. Neither proposition can be justified.

Apparently they misinterpreted an isopach chart which was presented by Reserve at the May, 1969, hearings principally to show the general shape and location of the tailings layer on the lake bottom--not as a measurement of tonnage. The chart shows a four-inch thick contour line--meaning that the layer of tailings on the bottom in the area inside that contour line was four inches or thicker--not four inches throughout. The data and testimony presented with the isopach chart by Reserve specifically pointed out that as one approached the delta and the path of the heavy density current, the layer was much thicker--as much as 50 feet thick.

Only by ignoring the great tonnages of tailings in the very thick layer on the lake bottom in the path of the heavy density current and near the toe of the delta can anyone believe such large tonnages of tailings are "missing."

If the FWPCA assumption were correct and the missing tailings had either gone into solution or were floating about in the lake, the water in the Silver Bay area should be the highest in the lake in metallic elements in solution, or turbidity, or suspended solids. Actually, however, both Reserve's and the FWPCA data shows this is not the case. Surface and mid-depth waters of the Silver Bay area were found to have lower turbidity and lower or the same metallic element analyses than the balance of the lake sampled.

SECTION III.

TACONITE TAILINGS HAVE NO ADVERSE EFFECT ON AQUATIC LIFE

At the executive session, representatives of the FWPCA relied on a Minnesota report entitled "Bottom Fauna of the Minnesota North Shore of Lake Superior as Related to Deposition of Taconite Tailings and Fish Production," but submitted opinions not supported by the very study relied on as foundation.

The FWPCA emphasized that the State studies reflected a decline in the production of pontoporeia, or scuds--a bottom fish food--in the area of Reserve's discharge of tailings. The report itself and testimony at the Conference by those State officials responsible for the study placed the decline in proper perspective by saying that it "may be associated with tailings." To show how insignificant this decline was, the statement of those Minnesota agencies said:

> "The reduction of commercial value of fish is estimated at $6.40 per square mile per year or less. The area considered extends out from the Minnesota shore about one mile to depths of 400 feet, and down the shore at least 15.5 miles (the limit of the present samplings). At this distance the tailings deposits were very thin."

In other words, the possible overall loss in the value of the commercial fish catch was about $100 per year. But, after pointing out that the scuds in that area would primarily be eaten by smelt, they stated that:

> "There is no evidence that there has been a decline in the Minnesota catch of smelt because of operation of the taconite plant."

They further stated:

> "It should be emphasized that the foregoing calculations are not exact, but they do indicate that the effect of the tailings on fish production within the area where the tailings are deposited is small and that the bulk of the fish food in the area is of free swimming (pelagic) organisms (such as fish and mysid shrimps) and not of bottom fauna that may be affected by tailings deposition."

The agencies' report then goes on to say:

> "Differences in production as small as those calculated from decrease in bottom fauna, five per cent or

> less from the area considered, would not be detectable in the commercial catch, considering the many other factors that influence it."

The report also says:

> "It should be emphasized that the foregoing calculations on the possible effect on the fewer fish food organisms found are theoretical only. There is no evidence from data on the commercial and sport fishing catch along the North Shore of Lake Superior to show there has been an actual reduction in fish production."

In conclusion, the Minnesota Conservation Department reported to the conferees:

> "Our studies of the record and of the lake indicate that present taconite operations are not currently having an appreciable effect on fish production in the lake."

A report of the Department of the Interior, Bureau of Commercial Fisheries, dated August 14, 1968, was introduced at the May 13-15 hearings of the Federal-State Conference. In part, it said:

> "Great changes have occurred in the fish population of Lake Superior, but no evidence was found during a review of commercial fishing statistics that taconite waste is influencing the populations."

After pointing out that there was no evidence of adverse effect by tailings on any species of fish, their report states with respect to lake trout:

> "* * * no evidence is available to indicate that there is any relation between the present status of the lake trout population and taconite operations."

In spite of this testimony, FWPCA spokesmen, on September 30, attempted to show that values of fish food organisms have been reduced rather drastically by taconite tailings. This is obviously an exaggeration and an assumption, at best--not supported by the data.

At the executive session, Federal spokesmen pointed out that the population of pontoporeia continued to decrease as one got further away from Silver Bay in the direction of prevailing currents (southwesterly). The theory offered was that some unknown effect of tailings on bottom fauna increased with distance; that the effect was the most pronounced at a point where tailings constituted the merest trace on the lake bottom (about .02 inch). This theory ignores completely the fact that there are substantial natural changes in the make-up of the lake bottom as one progresses southwest from Reserve's plant. This change alone could well be the cause of the decline in pontoporeia. A FWPCA spokesman acknowledged this when he stated:

> "What you have to realize that with these reports I am restricting this to a definite type of bottom sediment. These animal numbers can change if the bottom sediment changes, if we are talking about bottom animals, but in what I was just talking about I was talking about a more or less uniform type of bottom sediment. * * * " (Page 75 of transcript.)

In the area sampled, from about five miles northeast of Reserve's plant to some 15 miles to the southwest, the bottom sediments are primarily fine materials, furnishing a natural base for such aquatic life. Further down the shore towards Two Harbors, the edge of the tailings deposit, the bottom sediments are substantially different, changing to a coarse sand and gravel, much less likely to support such aquatic life. At one point, 20 miles down the shore, attempts to dredge samples of this bottom fauna had to be abandoned because the bottom was gravel or rock, and no sediments or fauna could be picked up.

Those are not the only changes that could affect these bottom fauna. The Two Harbors-Duluth area has historically had more smelt than the deeper waters and rocky shorelines further north near Silver Bay. Since smelt are reported to be very efficient eaters of pontoporeia, the population of that bottom fauna would naturally decrease in a southwesterly direction from Silver Bay.

By using only selected portions of Reserve's data, the FWPCA erroneously concluded that tailings caused a decrease in pontoporeia, based on the pontoporeia count in bottom samples taken from a "no tailings" area northeast of Silver Bay, compared with the count where tailings were found. Had they chosen to use a different "no tailings" area (southwest of the plant) in their comparison, they would have found 38% more pontoporeia in the tailings sediment than in the "no tailings" area. By using the pontoporeia count in still another "no tailings" area, other data shows there are as much as 111% more pontoporeia in the tailings sediments than in the "no tailings" sediments. Obviously, the results depend entirely on which "no tailings" area bottom samples are used and which data are ignored.

The above examples are only a few of many that show what widely divergent conclusions can be drawn from incomplete analyses of insufficient data. Certainly the data does not support a charge that tailings affect bottom fauna.

As to the claim that tailings might be "blanketing" bottom fauna, spawn and tiny fish, a FWPCA spokesman admitted that there would be no difference between natural sediments entering the lake from streams and rivers and tailings from Reserve's discharge:

> "* * * and I am certain that if there is enough heavy natural sediment deposition, there will be adverse effect there, too. I wouldn't make any distinguishing effects in the terms of the blanketing." (Page 85 of the transcript.)

In the May Conference, extensive data was submitted by Reserve demonstrating that the natural sediments are finer than tailings and that natural sediments contain higher concentrations of the objectionable heavy metals which could have an adverse effect on bottom fauna. Therefore, there is no support for any claim that the particle size or chemical composition of tailings has any deleterious effect on fish food organisms.

In view of all these considerations, there is no basis or justification for any conclusion that Reserve's operation has had a material or significant adverse effect on either fish or other aquatic life in Lake Superior.

SECTION IV.

ARE TAILINGS SOLUBLE?

Reserve tailings are virtually insoluble in Lake Superior; they are insoluble for all significant or practical considerations. However, an FWPCA spokesman gave the public quite a different picture. Using only a portion of the data supplied by Reserve at the May 13 Conference, he noted the minute changes (sometimes cited in parts per billion) in water chemistry between the plant water intake and the tailings discharge. He expressed the change only in percentages, not mentioning the quantities involved, thus giving an unwarranted, exaggerated idea of the significance of the change. To report an increase in an element from 0.005 mg/l (parts per million) to 0.006 mg/l as a 20% increase and to imply that this would constitute chemical pollution is absurd because the values are so low. That is, a change of from one cent to two cents is a 100% increase, but it is an insigificant part of a million dollars. In fact, such a percentage change is well within the margin of error in analyzing the samples. For instance, a .45 micron filter permits some of the fine particles to pass through it and be recorded as if in solution when in fact, the particles are only in suspension. As we point out later in the case of iron, that margin of error is very substantial.

Further, the spokesman was wrong in attributing all of the changes to tailings and wrong in stating that the chemical changes would continue when the tailings were in the lake. The facts do not support those assumptions. The figures he cited--chemical changes between the intake and discharge water--were presented by Reserve at the May Conference. They show that such changes are so minute as to be of no significance.

In reality, the data showed the total changes in the water by Reserve's use--not just changes resulting from contact between water and tailings. These changes can be caused by such diverse factors as dust-size particles of steel worn away from crusher liners, grinding rods and balls; materials worn from pumps, pipes, launders, by the movement of water and tailings in the plant; or from soluble materials which might cling to the surface of the crude taconite from the mine.

These changes, then, have no relationship to any possible chemical changes in the tailings after they are in the lake. The insigificant increase in iron and manganese is partly due to these metallics worn off the manganese steel liners and grinding rods and balls.

The FWPCA spokesman admitted that in the case of copper--the element which has been most frequently mentioned in the past--as well as nickel, the analysis was the same for both intake and discharge--there was no increase as a result of Reserve's operation. Both Reserve's analyses and samples by the Bureau of Mines showed there was an actual decrease in zinc.

More recent tests, by three different techniques, verify that zinc, copper and phosphorus are actually sorbed from the lake water by tailings--that is, tailings actually remove these elements from the lake water, though to an insignificant degree. Nickel is inactive, the tests show.

These four elements--zinc, copper, nickel and phosphorus--are the four trace metals which are generally recognized as having the most serious potential pollutional effect on water quality. Three of them are decreased in the lake water by tailings; the fourth is unchanged. (A typical complete chemical analysis of Reserve's tailings shows that these metallic elements are very low in Reserve's tailings and in the form of complex oxides or silicates which are insoluble in Lake Superior water.) Iron and manganese on the other hand are contributed to the water by tailings, as well as by natural sediments--again in insignificant amounts. However, the increase in iron--which the FWPCA treated as iron in solution--is due in large measure to fine particulate matter passing through a .45 micron filter, rather than being in solution. This is easily demonstrated by re-filtering the liquid through a .1 micron filter--the great majority of the remaining iron will be removed as solids. Therefore, it is obvious that the increase in iron due to Reserve's use of the water is not significant; the great majority is particulate, not dissolved matter.

Reserve, at the May Conference, also reported on the results of extensive tests at permanent water sampling stations in the Silver Bay area of the lake. The report included data from some 4,000 chemical and physical analyses. This data showed that the tailings--in the beach, in bottom deposits or within the heavy density current--do not affect the chemistry of Lake Superior water. Also, analyses of water samples from these permanent sampling stations and comparison of tailings analyses and analyses of tailings sediments on the lake bottom both show that tailings are not further increasing either the iron or manganese analysis of the lake water.

As in the case of most of the other matters investigated at the Conference, the subject of fine particles in suspension and possible solution of some minerals was carefully investigated and thoroughly considered at the hearings on the granting of Reserve's permits in 1947 and in the hearings later held on amendments of these permits. For example, at the 1947 hearings, Dr. John B. Moyle, a scientist who has been associated with the State Department of Conservation for many years, reported on his studies of the question of suspended and possibly dissolved minerals in taconite tailings. He testified that there would be no significant effect in these respects on the lake water as a result of full scale Reserve operations:

> "The conclusion I draw from my analyses of the water is that, from the chemical standpoint, the wash water will have no effect on fish and will have no appreciable effect on the chemistry of Lake Superior. It is just too low in salts of all kinds."

The FWPCA also completely ignored the comparison between the analysis of Reserve's tailings and analyses of the natural sediments deposited over thousands of years on the lake bottom. These natural sediments contain most of the metallic elements that exist in tailings--in equal or greater concentrations, with the exception of iron and manganese. As to size, natural sediments on the bottom brought into the lake by streams or by wave action on the rocky shores, sand beaches and clay banks, are finer than the fine fraction of Reserve's tailings. Yet, they have settled out on the bottom and over thousands of years, Lake Superior remains clear and unpolluted.

COMMENTS ON "TECHNICAL REPORTS"

Report No. 1 - Physical Characteristics of Green Water along the North Shore of Lake Superior

This information was originally published December, 1968 by FWPCA under the title "Special Report on Water Quality of Lake Superior in the Vicinity of Silver Bay, Minnesota." This Report only contains the results of 30 samples and observation secured during only 11 days. This is far too little data upon which to premise reliable conclusions on such a complex subject.

Certainly, during storms and shallow thermocline conditions tailings do cause some so-called green water in the vicinity of Reserve's discharge and harbor. Even during these conditions, the color of the water is not measurable by standard methods of measuring water color and the turbidity does not exceed the most rigid State and Federal standards.

Only the crystalline, inorganic material that would be detected by X-ray diffraction was considered. The amorphous inorganic material and organic material was not considered in this study.

Their results only indicate that suspended solids in water from different areas of the lake are different, and not that this difference in suspended solids is the basic cause of green water.

Their clear water samples were secured from three miles above Reserve's discharge to 15 miles northeast of the plant. The green water samples were secured from adjacent to Reserve's discharge to 19 miles southwest of the plant. Also, the green and blue water samples were not taken on the same days. Their discussion indicates that there was blue and green water very close together in the same general area of the lake that they could and should have sampled. Had they made these comparisons, it is our belief, they would have found very little difference in the analyses of the suspended solids in the blue and green water.

The authors of the Report did not determine color by standard methods. Reserve's results indicate that when the standard methods are used to indicate the color of the water as water quality criteria specify, both the blue and the green water are the same color, essentially colorless. The apparent green color is caused by a scattering of light due to the suspended particles as Messrs. Andrew and Glass report. "Green water" does not adversely affect water quality.

The clear water did average 0.5 mg/l of suspended solids and the green water averaged 2.0 mg/l. However, there would probably have been very little spread between these values had their samples been taken from adjacent areas of blue and green water.

The words "caused by tailings" are conjecture inasmuch as they have only measured one of the three potential causes of the turbidity.

Inasmuch as it is now acknowledged that cummingtonite enters Lake Superior via numerous streams, the mere qualitative showing of cummingtonite's presence among solids found in green water does not mean that the mineral originated from Reserve's discharge.

Report No. 2 - Distribution of Taconite Tailings in the Sediments of the Western Basin of Lake Superior

Some of the data in this report confirms Reserve's earlier presentation that cummingtonite is indeed found in numerous Minnesota and Wisconsin streams. Further, it shows that variations in the concentration of cummingtonite on the lake bottom are not necessarily due to Reserve's discharge, since similar variations are found well beneath the top layer of some of their bottom cores.

The FWPCA secured their North Shore stream samples from the north side of Highway 61. Had they secured these samples from the lake side of Highway 61, they would have also picked up the effect of road construction and sanding with tailings and their cummingtonite analysis would have probably been at least

1-2% higher. Assuming only 1% higher cummingtonite analysis due to truck hauled tailings along the North Shore, the average of all streams and the standard deviation would have been higher. Recalculating on this basis only leaves four stations, 20, 40, 42 and 7, which have higher than expected cummingtonite. These stations are outside of the area that Reserve has previously reported to be covered by their tailings. There is no apparent reason for the higher cummingtonite in the surface layers of these bottom samples. They are so widely scattered that it is unlikely that the cause could be taconite tailings.

Report No. 3 - Effect of Taconite on Bacterial Growth

Tailings are not a source of bacterial contamination and do not contribute bacteria to the lake. Tailings, like any other suspended solids found in Lake Superior, may provide surface area on which bacteria may attach.

It is suggested that normal suspended solids to the Lake should be used as a control to compare with tailings on tests of this type. It is possible that natural lake sediments would give the same results as taconite tailings.

The test procedure reported reflected that flasks of tailings were autoclaved for 15 minutes at 15 pounds steam at 250° F. This pressure and temperature may have been sufficient to cause some elements to dissolve in the water, which could bias the results.

Additionally, the test procedure utilized indicated that the bacteria used as test organisms were incubated at 68° F (20° C) for three days, which is unrealistic. The normal lake temperature is far lower.

No demonstrable problem with bacteria has been encountered in over 14 years of operation. There is much less likelihood of any problem arising in the future because of the development of additional municipal sewage plants.

There has been no demonstrable harm or increase in turbidity evidenced over the plus 14 years of the Company's operation. While it is conceivable that bacteria can attach to tailings, the same is true with any other sediments or particulate matter and tests do not support the conclusions suggested.

Report No. 4 - Taconite Bioassays

The survival rate of the control organisms was well below the accepted levels, therefore, no meaningful conclusions can be drawn from this data. Standard Methods of the Examination of Water and Wastewater, 12th Ed., page 554, states:

> "There should be no more than 10% mortality among controls during the course of any test, and at least 90% must remain in apparently good health."

Mr. Lemke, himself, commented on this low survival rate as follows:

> "The low control survival for most organisms suggests that either test conditions and/or test animals were not optimum. If anything, the effects of taconite on the test animals should have been greater due to stress from test conditions or inferior animals and therefore the effects would appear abnormally severe."

If further studies should establish any support whatsoever for the conclusion that "Direct toxic effects of tailings on lake organisms were found at concentrations that would be expected to occur only in local areas of the lake," the local areas that would have over 200 mg/1 suspended solids are extremely small just off our tailings discharge, probably less than 1,000 square yards in total.

Report No. 5 - Effect of Taconite Tailings on Algal Growth

Every value of this test is within their announced experimental error of their control. Therefore, no conclusion can be drawn from this data.

Tailings were heated up to 140° (60° C) for pasteurization. This is sufficient temperature to cause some silica to go in solution which would have not gone into solution at the temperatures encountered in Lake Superior.

Further, even the "control" had an algal bloom (greater than 500 cells per ml) before the test started and Lake Superior does not have that population of algae.

The report suggests that the nutrients (silicon, magnesium, sodium, potassium, and manganese) "* * * could contribute to eutrophic effects". This is true only if any of these elements are limiting to algal growth in Lake Superior. There is no evidence given that they or any one of them is limiting in Lake Superior. Evidence for silicon in Lake Michigan is not necessarily applicable to Lake Superior and indeed is probably not applicable there. Lake Michigan has a higher phosphate concentration than Superior; therefore, silicon could very well be limiting in Michigan but less likely to be so in Superior.

Results of the study do not specify diatoms as the group that increased (though they might have been). Furthermore, the usual conception of eutrophication is an increase in other types of algae, especially the blue-green and green algae. An increase in diatoms is not generally viewed as evidence of eutrophication.

Evidence does not show that "increased growth rates are related to increases in soluble silica * * *".

Referring to Tables 2 and 3, it is not shown by the data that growth rates do increase in the presence of tailings. By plotting the data on linear paper, it can be seen that the rates of change in cell count between day 11 and day 18 is not noticeably different for the tailings. Between the 9 and 11 days the control increased at a higher rate than for the 0.1% tailings.

The proper data to examine are the differences with time. Ignoring the plus and minus values given in Table 2, the differences are as follows:

Based on Table 2, Andrew & Glass

	Increase in cells/ml		
Concentration	0-9 Days	9-11 Days	11-18 Days
10% tailings	?	1130	2070
1% tailings	?	820	1910
0.1% tailings	?	430	1730
Control	?	530	1780

The differences in the 11-18 days column are almost certainly not statistically different. It is impossible to check this because the counting data (number of counts and variance) is not given.

A serious fault in these data is the omission of cell counts for the initial day. It is assumed that the counts were equal based on the use of lake water as the innoculant but without confirmatory counts, this is not an acceptable assumption.

Chlorophyll data (Table 3) are similarly misleading, see Figure 1. Here, the rate of increase is almost precisely equal for the 1%, 0.1% and control flasks between the 10th and 18th days. The 10% flask does show a larger rate of increase. Again, no time zero data are given.

Sample	Chlorophyll Increase (ug/l) 10-18 Days
10% tailings	2.03
1% tailings	1.02
0.1% tailings	1.06
Control	1.07

There are no data for time zero, the results are given in cell counts but the conclusions refer to rates of growth, the chlorophyll analyses and the cell counts agree only in a very general sense, and the added surface provided by the tailings is totally ignored as a factor. The conclusions do not follow from the data.

It is likely that 10% tailings will lead to increased growth of algae in the laboratory, but in the lake, this concentration (if it existed near the surface over a significant area) would reduce light penetration and thereby inhibit algae growth. In fact this argument was used in an earlier FWPCA report. Actually 1% or less tailings are the important consideration in these, and in these amounts no significant increases in algae growth are demonstrated. At 0.1% tailings concentration, growth rate of algae is equal or less than in the controls.

There is, therefore, no evidence that tailings in the concentrations found in the photic zones of Lake Superior have any effect whatsoever on algae growth.

Report No. 6 - The Dissolution of Taconite Tailings in Lake Superior

Reserve Mining Company has followed the chemistry of Lake Superior water in their plant while they were using it and after it is discharged into the lake for a number of years. These results do not show the solubility of tailings that Dr. Glass secured from laboratory results when he endeavored to simulate lake conditions by utilizing in his test ultra-high purity water.

Reserve's results show that no increase in calcium in the plant, less than 1 mg/l increase through the plant of magnesium, sodium, potassium and slightly over 1 mg/l increase in silica.

Permanent station water chemistry studies over a two-year period, 1968-1969, show no increase in these elements after the tailings are discharged into the lake.

The intake and discharge analyses of Reserve's water is reported to the Minnesota Pollution Control Agency and a set of data was reported to the May 13-15 Conference. The permanent station water chemistry studies for 1968 were reported to the MPCA in the January - June Report for 1969. The 1969 data was reported in the October report, 1969. These permanent station studies include over 2,000 chemical analyses. Dr. Bright reported on the 1968 results at the May 13-15 Conference. Dr. Mount used a portion of the permanent station data for his Water Criteria Presentation at the September 30, October 1, 1969 Conference.

The Report describes the conduct of three series of tests. One at 68° F (20° C) for 90 days and two at 43° F (6° C), one for 28 days and one for 322-337 days. The tests at 68° F for 90 days represent unrealistic conditions when contrasted with the actual Lake temperatures.

Dr. Glass notes in his report:

> "The net rates of dissolution, Table 1, increase with decreasing concentration of tailings and dissolved solids. This is probably due to increased clumping of particles in the higher concentrations resulting in less exposed surface area/gram of tailings."

This further indicates that tailings deposited on the bottom of Lake Superior constitute no solubility concern. In fact, they will cover the greater concentrations of more highly soluble natural sediments containing trace metals thereby retarding the introduction of soluble material into Lake Superior.

The best proof of solubility is actual Lake Superior water data. Hundreds of analyses of water samples obtained near Reserve's discharge show no difference between the chemistry of the heavy-density current water and open Lake water except for turbidity, iron and manganese. The latter three increases are expected.

It is suggested that if the author of the Report had chosen to run the same tests with natural sediments, he would have found higher rates of release than he did with tailings.

RESERVE MINING COMPANY

ENGINEERING TASK FORCE
PROGRESS REPORT

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April 9, 1970

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4	Fine Tailings Disposal by Deep Pipe Into Lake
5	Tailings Disposal Under a Protective Curtain
6	Coarse Tailings Rail-Hauled to Lax Lake Area All Year
7	Coarse Tailings Rail-Hauled to Lax Lake Area Summer Months Only
8	Coarse Tailings Conveyed to Lax Lake Area All Year
9	Coarse Tailings Conveyed to Lax Lake Area Summer Months Only
10	Coarse Tailings Rail-Hauled to Mile Post 32 All Year
11	Coarse Tailings Rail-Hauled to Mile Post 32 Summer Months Only
12	Fine Tailings Discharged Through An Underwater Diffuser
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INTRODUCTION

Last year Reserve Mining Company announced formation of an engineering task force to investigate and study any proposed possible method of altering or modifying its discharge of tailings (waste sand) to Lake Superior. Reserve does not believe its discharge is causing--in the language of the statutes--any material damage to Lake Superior or endangering the health or welfare of people of Minnesota or any other state. These studies were undertaken not because the lake was being harmed by Reserve's present tailings discharge system, but to determine if there were some other practicable method which would relieve the concern some people have about the company's use of the lake.

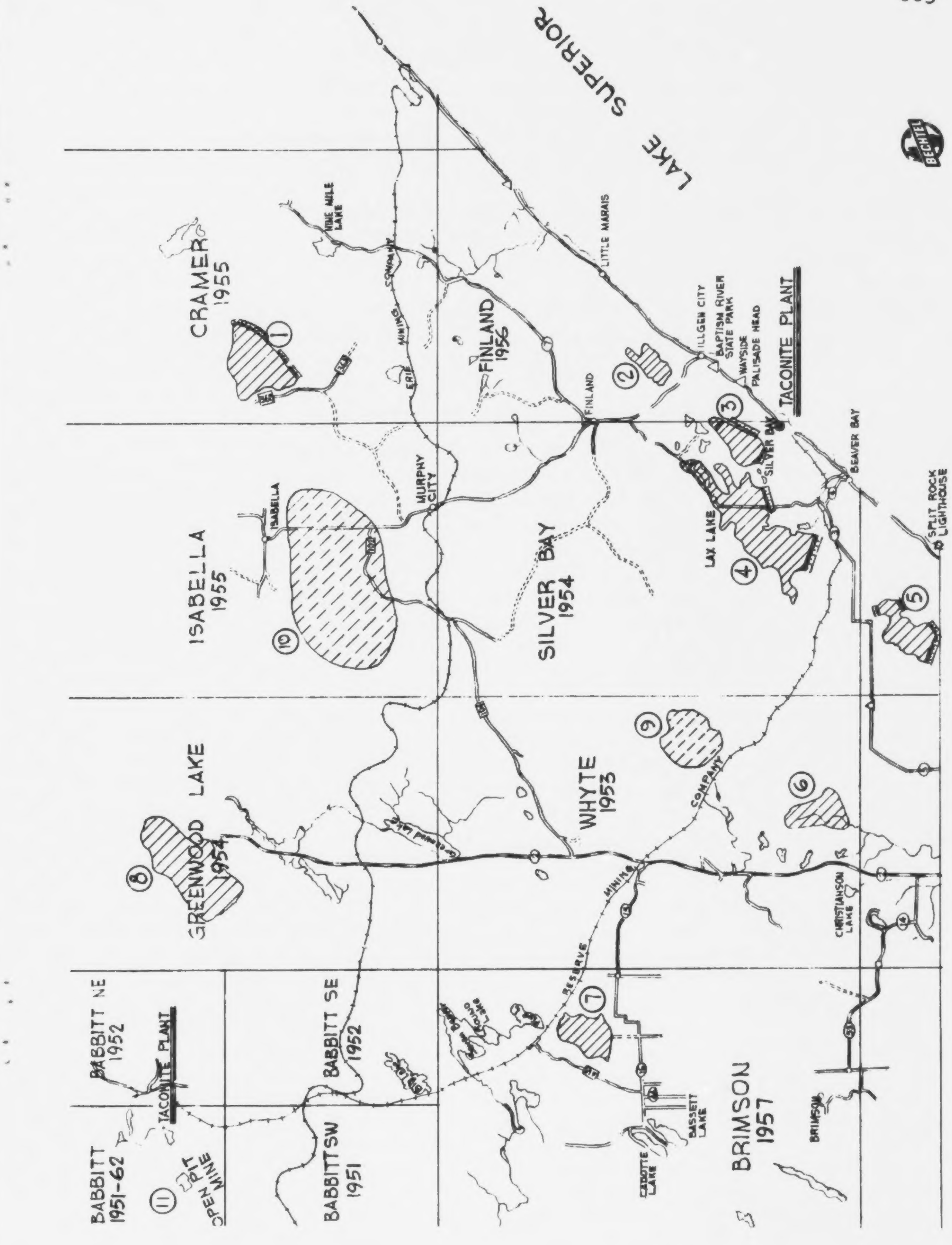
This task force--composed of Reserve engineers and scientists and specialists from nationally-known consulting engineering firms--has been expanded from time to time to include more engineers and new talents which were required as new ideas were conceived. Today, the consulting firms involved in one or more preliminary engineering investigation related to disposal of Reserve's tailings and their storage, handling or use are:

Bechtel Corporation
Engineering-Science, Inc.
Arthur D. Little, Inc.
Parsons-Jurden Corporation
Trygve Hoff & Associates

The following pages are a progress report prepared by Reserve Mining Company on investigations of all proposals; none have been omitted. In several cases where the study has not yet been completed, an estimated completion date is given. In no case is the completion date believed to be more than 60 to 90 days distant.

The entire Silver Bay-Babbitt region has been carefully studied for potential on-land disposal sites. Eleven locations which appeared to have possibilities initially are shown on the next page. Investigation revealed that only four sites appeared to have any possibilities whatever and they are considered in one or more of the attached proposals. In each case, the area described is the best suited for the particular proposal in which it appears.

The proposals involving thickening and clarifying require the use of flocculents or coagulants which make up a major portion of the operating costs cited. A settling agent approved for use in treating water for human consumption would be employed. To keep Reserve's finished product quality competitive, amines for flotation classification would be required. Only biodegradable amines would be used and all water used in flotation would be confined to a closed circuit. No portion of the costs of amine "closed water" classification systems is included in any of the following estimates.


BABBITT 1951-62
11
OPEN PIT MINE
TACONITE PLANT
BABBITT NE 1952
BABBITT SW 1951
BABBITT SE 1952
GREENWOOD LAKE 1954
8
ISABELLA 1955
10
ISABELLA
MURPHY CITY
CRAMER 1955
1
NINE MILE LAKE
ERIE MINING COMPANY
FINLAND 1956
FINLAND
LITTLE MARAIS
ILLGEN CITY
BAPTISM RIVER STATE PARK
WAYSIDE
PALISADE HEAD
TACONITE PLANT
2
3
SILVER BAY
LAX LAKE
4
BEAVER BAY
SPLIT ROCK LIGHTHOUSE
5
SILVER BAY 1954
WHYTE 1953
9
6
RESERVE MINING COMPANY
7
CHRISTIANSON LAKE
BASSETT LAKE
COYOTE LAKE
BRIMSON 1957
BRIMSON
LAKE SUPERIOR
BECHTEL

PROPOSAL #1

"TOTAL TAILINGS DISPOSAL IN LAX LAKE AREA"

ENGINEERING STUDY BY:
Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION:

This is a reasonably complete study of the proposal originally examined--but not recommended--by the U. S. Bureau of Mines that all Reserve tailings be pumped to a tailings basin in the area of Lax Lake above the high ridge behind Silver Bay.

Coarse tailings would be separated from fine tailings by hydroseparation. All tailings would be ground to -10 mesh and thickened. The thickener overflow would be returned to the concentrator as recycled water. Underflow from the thickeners, containing all of the tailings, would be pumped to the Lax Lake area over an 800-foot elevation from the level of the present delta and would be impounded behind dams. Water from the tailings pond would be returned to the concentrating plant as process water.

This study assumes that electric power can be purchased from Minnesota Power and Light Company, thereby eliminating the construction by Reserve of a power generating facility costing many millions of dollars. Construction of a power line from Duluth to Silver Bay to deliver 95,000 kw would be necessary, however.

PRELIMINARY EVALUATION:

The estimated partial capital cost of this proposal is $195,183,000 and does not include such items as land acquisition; preparation of the basin area; financing and interest; distribution pumping equipment; transmitting power, lights and communications at dams; abandonment of Lax Lake road (County Highway #4); permanent dam access roads; plant depreciation; inflation before construction is started; and computer rental.

Proposal #1

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$12,280,000
Depreciation	6,294,000
Interest	8,710,000
Total estimated average annual cost	$27,284,000

The proposal does not appear to be sound from a conservation standpoint. To the contrary, serious conservation problems would be encountered. The area suggested is prime hunting, fishing, recreation and resort country, with both seasonal and year-around homes. All would be covered by the tailings basin; Lax Lake itself would cease to exist. Dust from blowing tailings could be expected to affect the region.

Since the watershed drainage would exceed Reserve's total needs, excess water (containing fine tailings) from the basin would go into the Beaver River and enter Lake Superior--in spite of a series of dams so high and long that they would be among the largest in the nation.

Also, the fine tailings would enter the lake so "diluted" in the river water, no heavy density current would form to carry them to the great depths of the lake. The fine tailings would be in surface waters until they settled out naturally.

No "problems" would be solved. Further, the huge tailings basin poised high above the residences of the Beaver Bay region on the North Shore could be a safety hazard.

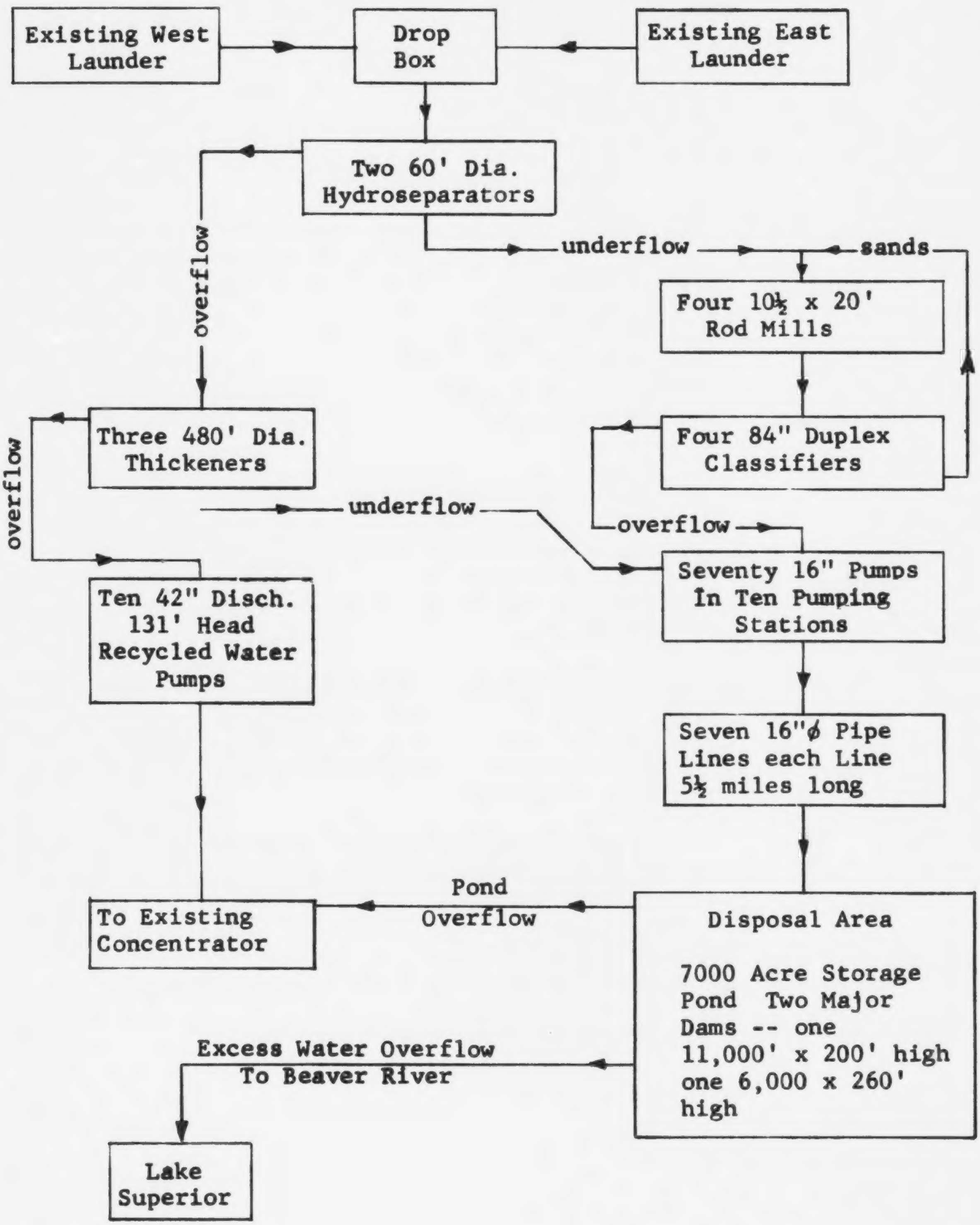
PROGRESS: Preliminary engineering study 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

FLOW SHEET

PROPOSAL #1

"TOTAL TAILINGS DISPOSAL IN LAX LAKE AREA"


Existing West Launder
Drop Box
Existing East Launder
Two 60' Dia. Hydroseparators
overflow
underflow
sands
Four 10½ x 20' Rod Mills
Three 480' Dia. Thickeners
Four 84" Duplex Classifiers
overflow
underflow
overflow
Ten 42" Disch. 131' Head Recycled Water Pumps
Seventy 16" Pumps In Ten Pumping Stations
Seven 16"ø Pipe Lines each Line 5½ miles long
Pond Overflow
To Existing Concentrator
Disposal Area
7000 Acre Storage Pond Two Major Dams -- one 11,000' x 200' high one 6,000 x 260' high
Excess Water Overflow To Beaver River
Lake Superior

PROPOSAL #2

"DISPOSAL OF TAILINGS NEAR TACONITE MINE"

ENGINEERING STUDY BY:
Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION: This proposal incorporates hauling all tailings by railroad to the Babbitt, Minnesota area, stacking the material on land south of the Reserve taconite mine.

Total tailings would be fed into drag classifiers which would remove the coarsest tailings to be carried by belt conveyors to a junction point. The finer tailings would be in the overflow from the classifiers and would be fed into four huge thickeners. Thickener overflow of relatively clear water would be returned to the plant as process water. Thickener underflow would be pumped to a filter building where the remaining tailings would be filtered out and discharged onto conveyors which bring them to the above mentioned junction point. Combined tailings would be conveyed up the hill on a belt conveying system to loading bins in the rail yard. At this point the tailings would contain 20% moisture. The material would be loaded into railroad cars and transported to an area south of the Babbitt pit. The railroad cars would be dumped by car dump facilities installed at Babbitt and the damp tailings stacked 50 feet high over a large area. For winter operations, a thaw shed would be built to thaw out frozen cars.

PRELIMINARY EVALUATION: The estimated partial capital cost of $74,132,000 does not include such items as land acquisition; financing and interest; plant depreciation; inflation to date of construction; the necessary addition to the distribution system at Babbitt after five years of stacking; computer rental; repair, maintenance and fueling facilities for rail operating equipment; dust collectors at loading and unloading sites; gas main to heating boiler; nor air pollution control equipment.

Proposal #2

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 6,210,000
Depreciation	2,972,000
Interest	3,308,000
Total estimated average annual cost	$12,490,000

Reserve engineers believe the thaw shed equipment appears to be inadequate for winter operation and that it might be necessary to use electrically heated, insulated railroad cars, in addition to that thaw shed for emergency use only. However, such cars are new and untried and would require pilot operations before being considered.

Also, the conveyor system planned would suffice for only five years' operations. Additional and more flexible conveyor systems would have to be designed and evaluated before this proposal could be considered.

Engineering and operating difficulties make this proposal highly questionable from a technical feasibility standpoint.

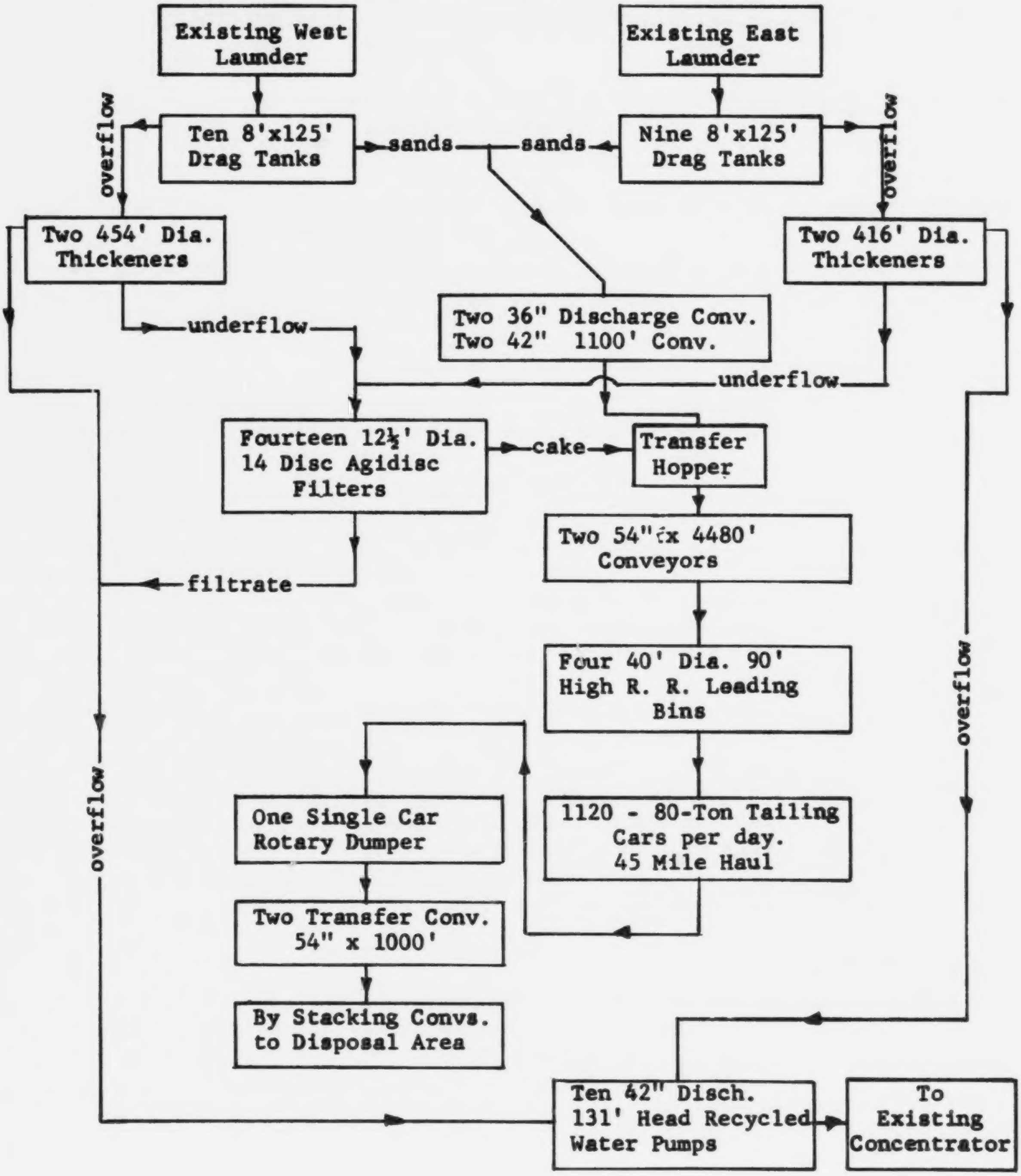
PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

FLOW SHEET

PROPOSAL #2

"OVERLAND DISPOSAL OF TAILINGS BY RAILROAD"


Existing West Launder
Existing East Launder
overflow
Ten 8'x125' Drag Tanks
sands
sands
Nine 8'x125' Drag Tanks
overflow
Two 454' Dia. Thickeners
Two 416' Dia. Thickeners
underflow
Two 36" Discharge Conv. Two 42" 1100' Conv.
underflow
Fourteen 12½' Dia. 14 Disc Agidisc Filters
cake
Transfer Hopper
Two 54" x 4480' Conveyors
filtrate
Four 40' Dia. 90' High R. R. Loading Bins
overflow
One Single Car Rotary Dumper
1120 - 80-Ton Tailing Cars per day. 45 Mile Haul
overflow
Two Transfer Conv. 54" x 1000'
By Stacking Convs. to Disposal Area
Ten 42" Disch. 131' Head Recycled Water Pumps
To Existing Concentrator

PROPOSAL #3

"DISPOSAL OF FINE TAILINGS ONLY IN THE LAX LAKE AREA"

ENGINEERING STUDY BY: Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION: This proposal would separate total tailings into a fine (-500 mesh) fraction and a coarse (+500 mesh) fraction. The fine fraction would be pumped to a tailings basin in the Lax Lake area. Coarse tailings would be deposited across a delta and into Lake Superior as Reserve now disposes of its total tailings.

Total tailings would flow to drop box separators where the coarse tailings would settle out and be pumped to a mixing station. Overflow from the drop box separators would feed into four thickeners. Thickener underflow would be +500 mesh material. It would be pumped to a mixing station where sufficient water would be added for it to flow down launders and discharge across the delta in a system similar to the present one employed by Reserve. These tailings would form a heavy density current and be carried to the bottom.

The thickener overflow would go to six clarifiers. Overflow from the clarifiers would be returned to the plant as process water. Underflow (-500 mesh) would be pumped to the Lax Lake area and retained behind rock dams in a sufficiently large tailings disposal area to allow overflow of reasonably clear water to the Beaver River. The clear water overflowed to the Beaver River probably would be less than 25 JTU.

PRELIMINARY EVALUATION: Partial estimated cost of $62,933,000 does not include such items as land acquisition; clearing of basin area; financing and interest charges; distribution pumping; power, lights and communications equipment at dams; permanent dam access roads; plant depreciation; inflation; and computer rental.

Proposal #3

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 5,589,000
Depreciation	1,893,000
Interest	2,808,000
Total estimated average annual cost	$10,290,000

The thickeners and clarifiers were sized on rather sketchy theoretical data. The pilot plant was operated during the months of January and February to develop actual data on the size equipment needed for these separations and classifications. This data indicates that the thickeners planned were slightly oversize and the clarifiers were slightly undersize. The overall effect should be essentially no change in the estimated capital and operating costs.

Many problems would result from this proposal because of the large tailings basin located in a resort, hunting, fishing and year-around residence region. There would be dust blowing from the tailings pond. The overflow from the tailings basin would be continuous. Fine tailings would be carried into the Beaver River and to Lake Superior. The tailings entering Lake Superior via the Beaver River would be too diluted to form a heavy density current. Therefore, they would settle to the lake bottom much slower than those entering the lake by our present practice. The tailings delta would have the same appearance that it does now.

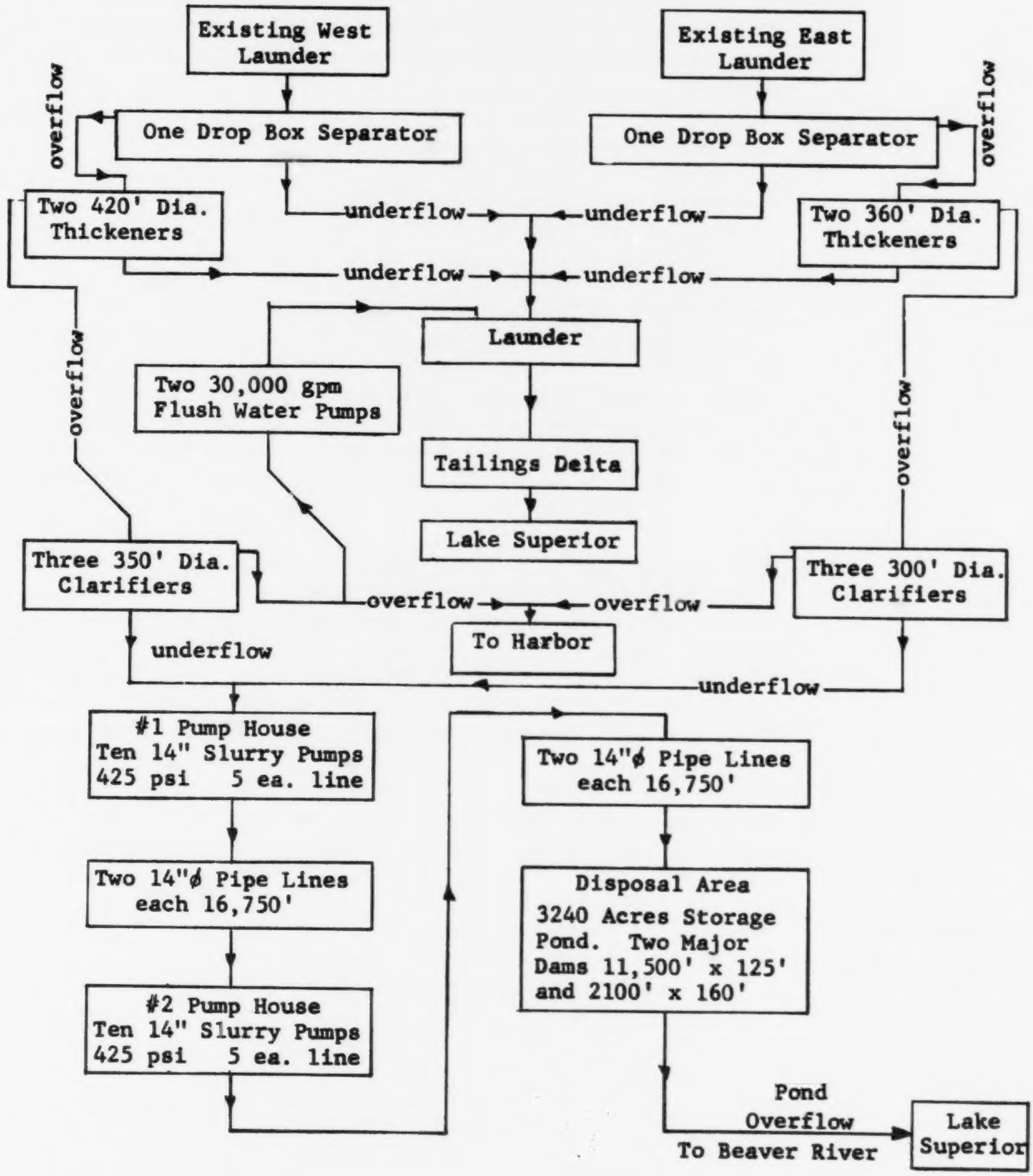
PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

FLOW SHEET

PROPOSAL #3

"DISPOSAL OF FINE TAILINGS ONLY IN THE LAX LAKE AREA"


Existing West Launder
Existing East Launder
One Drop Box Separator
One Drop Box Separator
overflow
overflow
underflow
underflow
Two 420' Dia. Thickeners
Two 360' Dia. Thickeners
underflow
underflow
Launder
Two 30,000 gpm Flush Water Pumps
overflow
overflow
Tailings Delta
Lake Superior
Three 350' Dia. Clarifiers
Three 300' Dia. Clarifiers
overflow
overflow
To Harbor
underflow
underflow
#1 Pump House
Ten 14" Slurry Pumps
425 psi 5 ea. line
Two 14"ϕ Pipe Lines
each 16,750'
#2 Pump House
Ten 14" Slurry Pumps
425 psi 5 ea. line
Two 14"ϕ Pipe Lines
each 16,750'
Disposal Area
3240 Acres Storage Pond. Two Major Dams 11,500' x 125' and 2100' x 160'
Pond Overflow
To Beaver River
Lake Superior

PROPOSAL #4

"FINE TAILINGS DISPOSAL BY DEEP PIPE INTO LAKE"

ENGINEERING STUDY BY: Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION: Under this proposal, fine tailings would be pumped into Lake Superior via a submerged pipe below any surface-affecting thermocline. Coarse tailings would be deposited across a delta into the lake as total tailings are at present.

Briefly, total tailings would flow to drop box separators where the coarse tailings would settle out and be pumped to a mixing station. Overflow from the drop box separators would feed into four thickeners. Thickener underflow would be +500 mesh material. It would be pumped to a mixing station where sufficient water would be added for it to flow down launders and discharge across the delta in a system similar to the present one employed by Reserve. These tailings would form a heavy density current and be carried to the bottom.

The thickener overflow would go to six clarifiers. Overflow from the clarifiers would be returned to the plant as process water. Clarifier underflow would be pumped into Lake Superior through a pipe. The discharge end of the pipe would be 150 feet below the surface.

PRELIMINARY EVALUATION: Partial estimated capital costs of $14,854,000 do not include such items as financing and interest costs; submerged pipe extension and replacement; plant depreciation; inflation to construction date; computer rental; computerization of controls; additional capacity to provide for increased steam load for heating; sampling and standby equipment; and pump repair equipment.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 4,280,000
Depreciation	570,000
Interest	663,000
Total estimated average annual cost	$ 5,513,000

Proposal #4

The thickeners and clarifiers were sized on rather sketchy theoretical data. The pilot plant was operated during the months of January and February to develop actual data on the size equipment needed for these separations and classifications. This data indicates that the thickeners planned were slightly oversize and the clarifiers were slightly undersize. The overall effect should be essentially no change in the estimated capital and operating costs.

The proposal would place the fine fraction of the tailings below any surface-affecting thermocline, in this way virtually eliminating the small amount of tailings that may, under certain conditions, be found in the surface water.

The system answers some, but not all of the criticisms that have been made about the existing method of tailings disposal.

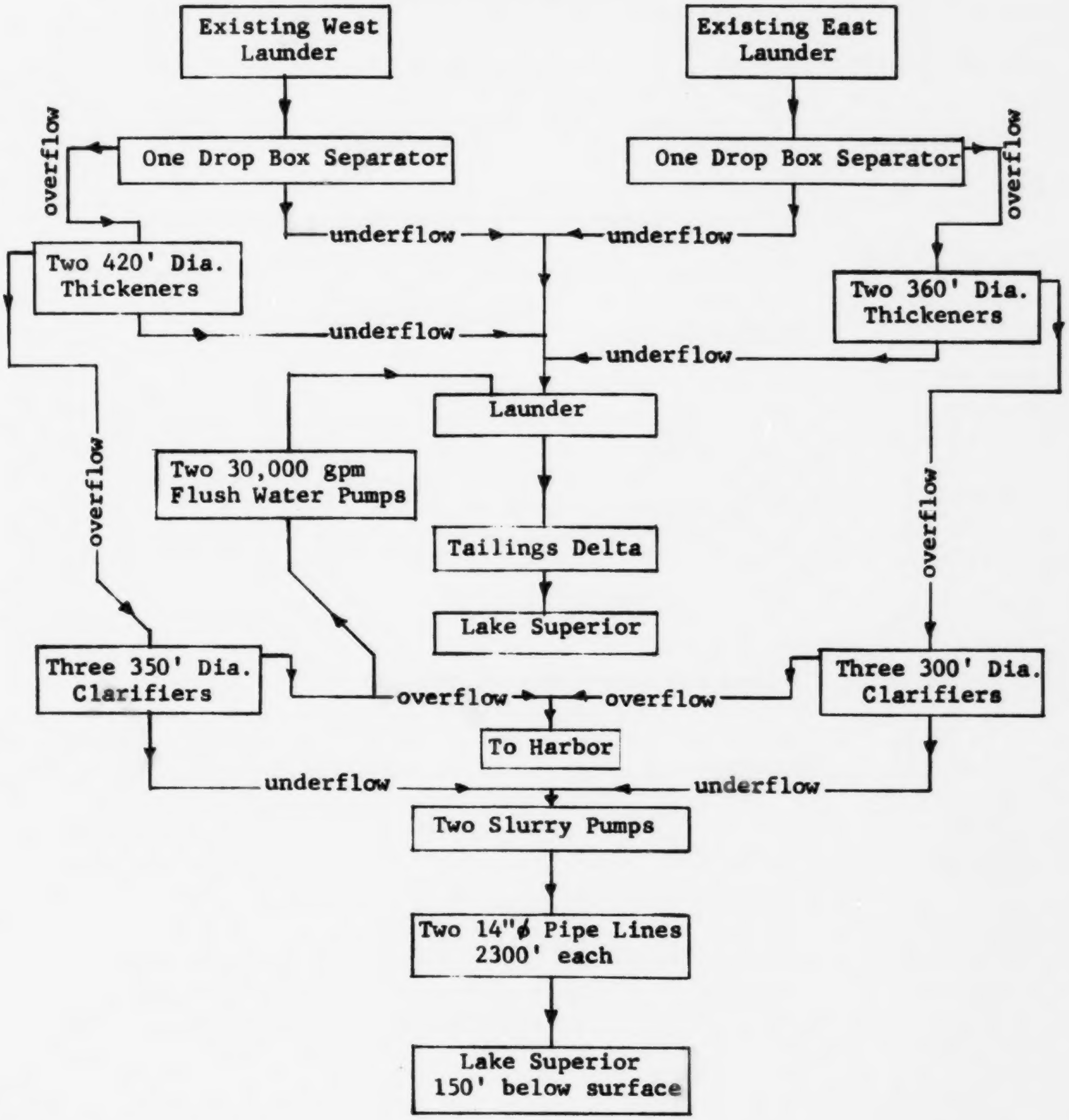
PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Further investigation abandoned for the present.

FLOW SHEET

PROPOSAL #4

"FINE TAILINGS DISPOSAL BY DEEP PIPE INTO LAKE"


Existing West Launder
Existing East Launder
One Drop Box Separator
One Drop Box Separator
overflow
overflow
underflow
underflow
Two 420' Dia. Thickeners
Two 360' Dia. Thickeners
underflow
underflow
Launder
Two 30,000 gpm Flush Water Pumps
overflow
overflow
Tailings Delta
Lake Superior
Three 350' Dia. Clarifiers
Three 300' Dia. Clarifiers
overflow
overflow
To Harbor
underflow
underflow
Two Slurry Pumps
Two 14"ϕ Pipe Lines 2300' each
Lake Superior 150' below surface

PROPOSAL #5

"TAILINGS DISPOSAL UNDER A PROTECTIVE CURTAIN"

ENGINEERING STUDY BY: Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION: Under this proposal the tailings flow from the Reserve delta would pass under a 100-foot deep vertical curtain to enter the lake below any thermoclines. Theoretically, this would eliminate or materially reduce the minor amount of tailings which, under certain conditions, may be found in surface waters.

From mid-October to mid-June, diversion dikes would control development and shape of the deltas of the two tailings launders (see accompanying sketch), forcing the ends of the divided beach to grow faster than the centers. As these protruding edges build up to the water surface level, they would be protected by rock dikes or clusters of pilings. This would produce a double-concaved delta edge, open toward the lake.

The diversion dikes would be removed or openings would be made in them from mid-June to mid-October. The curtain would be placed across the opening of each concave-shaped tailings delta. Edge diversion dikes might be necessary to direct the tailings stream to approximately the center of each delta concave. Heavy density currents would be contained by the delta shape and forced to flow under the curtain below the depth of the surface-affecting thermoclines.

PRELIMINARY EVALUATION: The partial estimated capital cost of $3,854,000 does not include such items as financing and interest cost; plant depreciation; and inflation to the construction date.

The average annual costs over the next ten years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 1,616,000
Depreciation	406,000
Interest	190,000
Total estimated average annual cost	$ 2,212,000

Proposal #5

This proposal would, in theory, prevent tailings from Reserve's discharge being found in surface waters.

A delta of this shape would also hold to a minimum the movement of tailings by wave action which now stirs the beach and may cause some fine tailings to be temporarily suspended in the surface water.

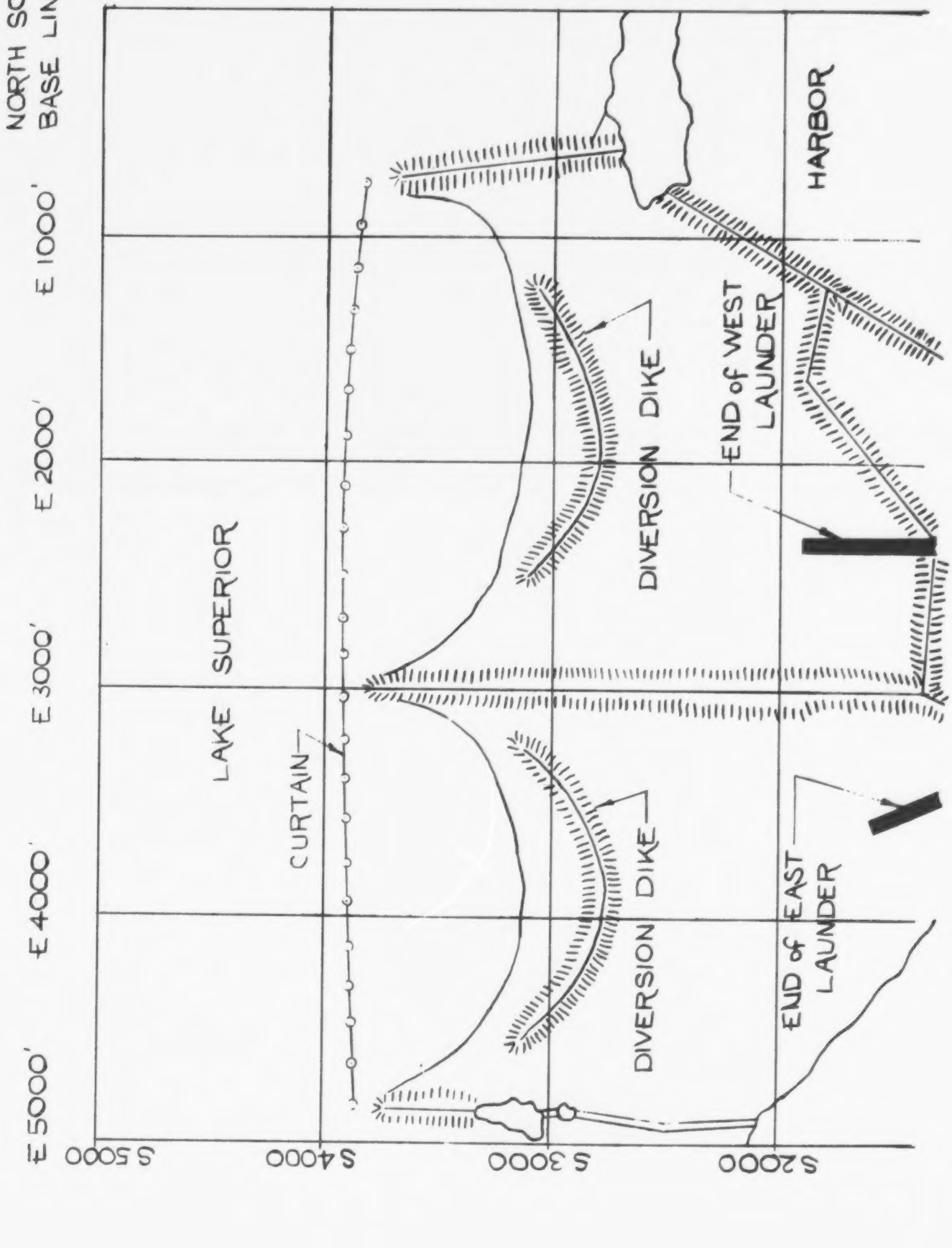
This proposal has the lowest capital and operating cost of the group. However, the curtain principle is entirely new and untried. The proposal would fail if the curtain could not be maintained in position against wave and current action. Reserve engineers believe other proposals present a higher probability of success.

PROGRESS: Preliminary engineering study 100% complete.

TIMETABLE: No further engineering work planned; proposal abandoned.

PROPOSAL #5

"TAILINGS DISPOSAL UNDER A PROTECTIVE CURTAIN"


NORTH SOUTH BASE LINE
E 1000'
E 2000'
E 3000'
E 4000'
E 5000'
S 5000
S 4000
S 3000
S 2000
LAKE SUPERIOR
CURTAIN
DIVERSION DIKE
DIVERSION DIKE
DIVERSION DIKE
HARBOR
END of WEST LAUNDER
END of EAST LAUNDER

PROPOSAL #6

"COARSE TAILINGS RAIL-HAULED TO LAX LAKE AREA ALL YEAR"

ENGINEERING STUDY BY:
Bechtel Corporation
50 Beale Street
San Francisco, California 94119

DESCRIPTION: Total tailings from cobber magnetic separators would be separated by spiral classifiers into +35 and -35 mesh. The +35 mesh product (about 50% of the total) would be belt-conveyed to storage bins at 18% moisture. These would be loaded into electrically heated, insulated railroad cars and hauled 5½ miles and then would be carried by belt conveyors to the Lax Lake area and spread by conventional stackers.

The spiral classifier overflow would be combined with the balance of the fine tailings and fed into thickeners through existing launders. The thickener overflow would be returned as relatively clear water to the plant for use in the process. Thickener underflow with the balance of the tailings would be pumped to the Lax Lake area and impounded behind dams constructed from the coarse tailings.

The pond overflow would be returned to the plant as process water. Excess water would be clarified to less than 25 JTU and returned to Lake Superior.

PRELIMINARY EVALUATION: Preliminary, partial estimates place the capital cost at $44,100,000 which does not include: land acquisition; financing and interest; inflation prior to construction; spare parts; operating supplies; higher unit power cost due to additional power requirements; and mobile equipment other than railroad rolling stock.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 3,750,000
Depreciation	2,105,000
Interest	1,968,000
Total estimated average annual cost	$ 7,823,000

Proposal #6

The hauling of tailings containing 18% moisture in winter presents real problems. Bottom-dump rail cars would dribble, causing icing on the railroad. The electrically heated insulated rail car is a new, untried concept and extensive pilot testing would be necessary before the system could be considered further. Also, the conveyor system from the classifiers must be re-designed before it will operate satisfactorily.

Serious conservation problems would result from adoption of a tailings basin in the Lax Lake area. This prime resort, hunting and fishing region and year-around residential area would be destroyed for these purposes. Dust from blowing tailings would be a problem. Very fine tailings would flow to Lake Superior from time to time because of the necessity for diversion and/or overflow via the Beaver River and Palisade Creek. Also, the huge tailings basin poised high above the Beaver Bay-North Shore area could be a safety hazard.

It does not appear to be feasible from a technical standpoint. No further engineering work is planned.

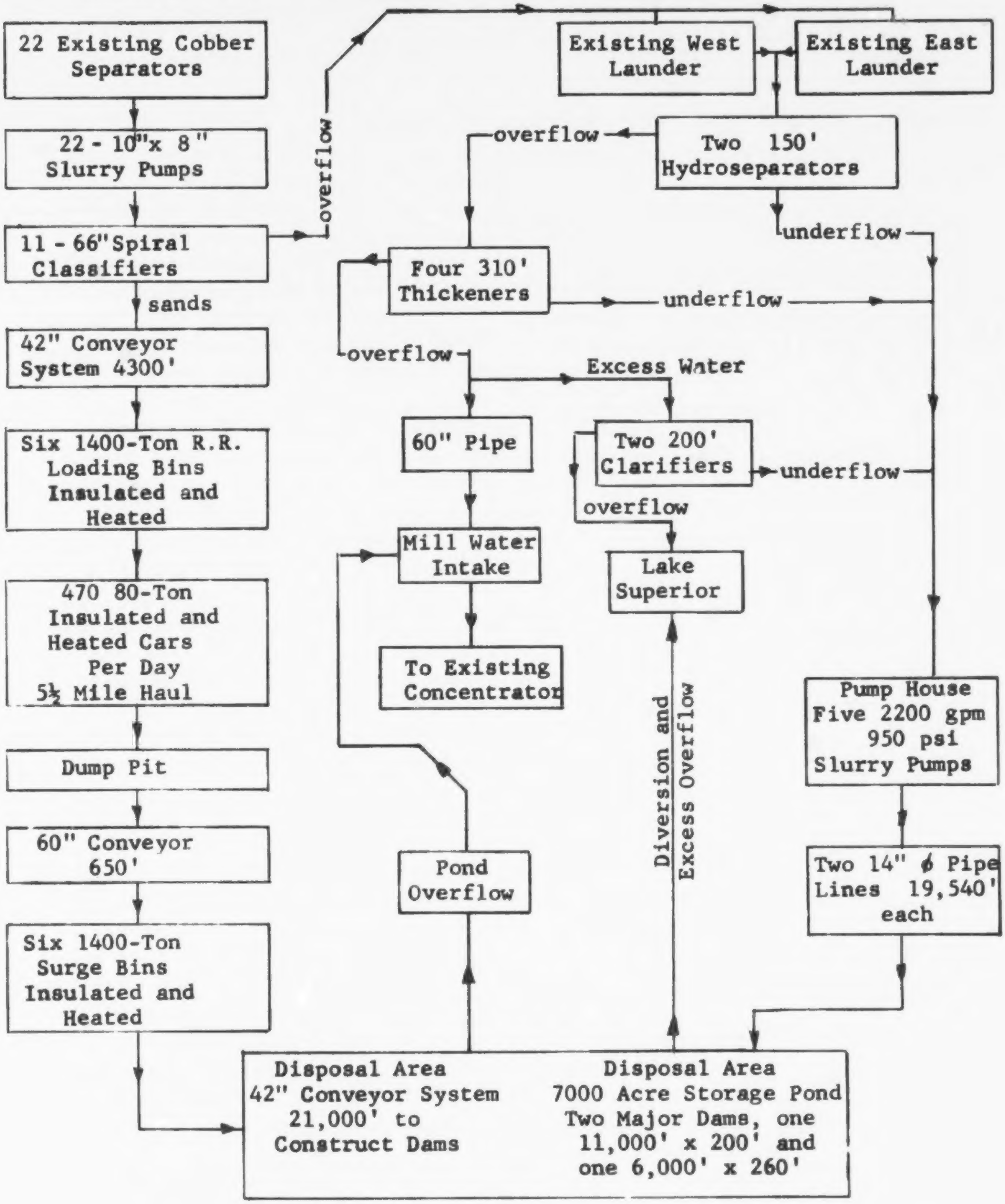
PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

FLOW SHEET

PROPOSAL #6

"COARSE TAILINGS RAIL-HAULED TO LAX LAKE AREA ALL YEAR"


22 Existing Cobber Separators
22 - 10"x 8" Slurry Pumps
11 - 66"Spiral Classifiers
overflow
sands
42" Conveyor System 4300'
Six 1400-Ton R.R. Loading Bins Insulated and Heated
470 80-Ton Insulated and Heated Cars Per Day 5½ Mile Haul
Dump Pit
60" Conveyor 650'
Six 1400-Ton Surge Bins Insulated and Heated
Existing West Launder
Existing East Launder
overflow
Two 150' Hydroseparators
underflow
Four 310' Thickeners
underflow
overflow
Excess Water
60" Pipe
Two 200' Clarifiers
underflow
overflow
Mill Water Intake
Lake Superior
To Existing Concentrator
Diversion and Excess Overflow
Pump House Five 2200 gpm 950 psi Slurry Pumps
Two 14" ϕ Pipe Lines 19,540' each
Pond Overflow
Disposal Area 42" Conveyor System 21,000' to Construct Dams
Disposal Area 7000 Acre Storage Pond Two Major Dams, one 11,000' x 200' and one 6,000' x 260'

PROPOSAL #7

"COARSE TAILINGS RAIL-HAULED TO LAX LAKE AREA SUMMER MONTHS ONLY"

ENGINEERING STUDY BY: Bechtel Corporation
50 Beale Street
San Francisco, California 94119

DESCRIPTION: Coarse tailings would be transported to the Lax Lake area during the summer months only by rail and conveyor belt. A stockpile of coarse tailings would be built at the plant site during the winter months. The fine tailings would be thickened and pumped to a tailings basin in the Lax Lake area all year around.

Cobber magnetic separator tailings would be spiral classified into +35 and -35 mesh product. The rake (+35 mesh) tailings (about 50% of the total) would be conveyed to a storage pile on the delta in the winter at 18% moisture. During summer months these coarse tailings would be reclaimed from the delta stockpile, loaded along with similar size summer production material into bottom-dump rail cars and hauled to mile post 5½. From there they would be belt-conveyed to the Lax Lake area and spread with conveyors and stackers. The overflow from the spiral classifiers combined with the balance of the fine tailings would be fed into thickeners through existing launders. The thickener overflow would be returned to the plant as process water and the underflow pumped to the Lax Lake area and impounded behind dams constructed of coarse tailings. Tailings pond overflow would go back to the plant as process water and excess water would be clarified to less than 25 JTU and returned to Lake Superior.

PRELIMINARY EVALUATION: Not included in the partial capital cost estimate of $49,400,000 are such items as land acquisition; financing and interest; inflation; spare parts; operating supplies; higher unit power costs due to additional power requirements; and mobile equipment other than railroad rolling stock.

Proposal #7

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$3,991,000
Depreciation	2,375,000
Interest	2,205,000
Total estimated average annual cost	$8,571,000

The conveyor system from the classifiers would have to be re-engineered before this system could be adopted. Also, at 18% moisture, much of the delta stockpile would be frozen so deep that reclaiming would be difficult even in the summer months.

The proposal does not appear to be sound from an environmental standpoint. The tailings basin would virtually destroy the Lax Lake area for its present uses--hunting, fishing, resorts and seasonal and year-around homes. Dust problems from blowing tailings could be expected to affect a wide area near the basin. This large tailings basin high upstream from the Beaver Bay-North Shore region could be a safety hazard. Also, very fine tailings would flow to Lake Superior from time to time via the Beaver River and Palisade Creek because of the necessity of diversion and/or overflow.

In addition, the technical feasibility of this proposal is questionable.

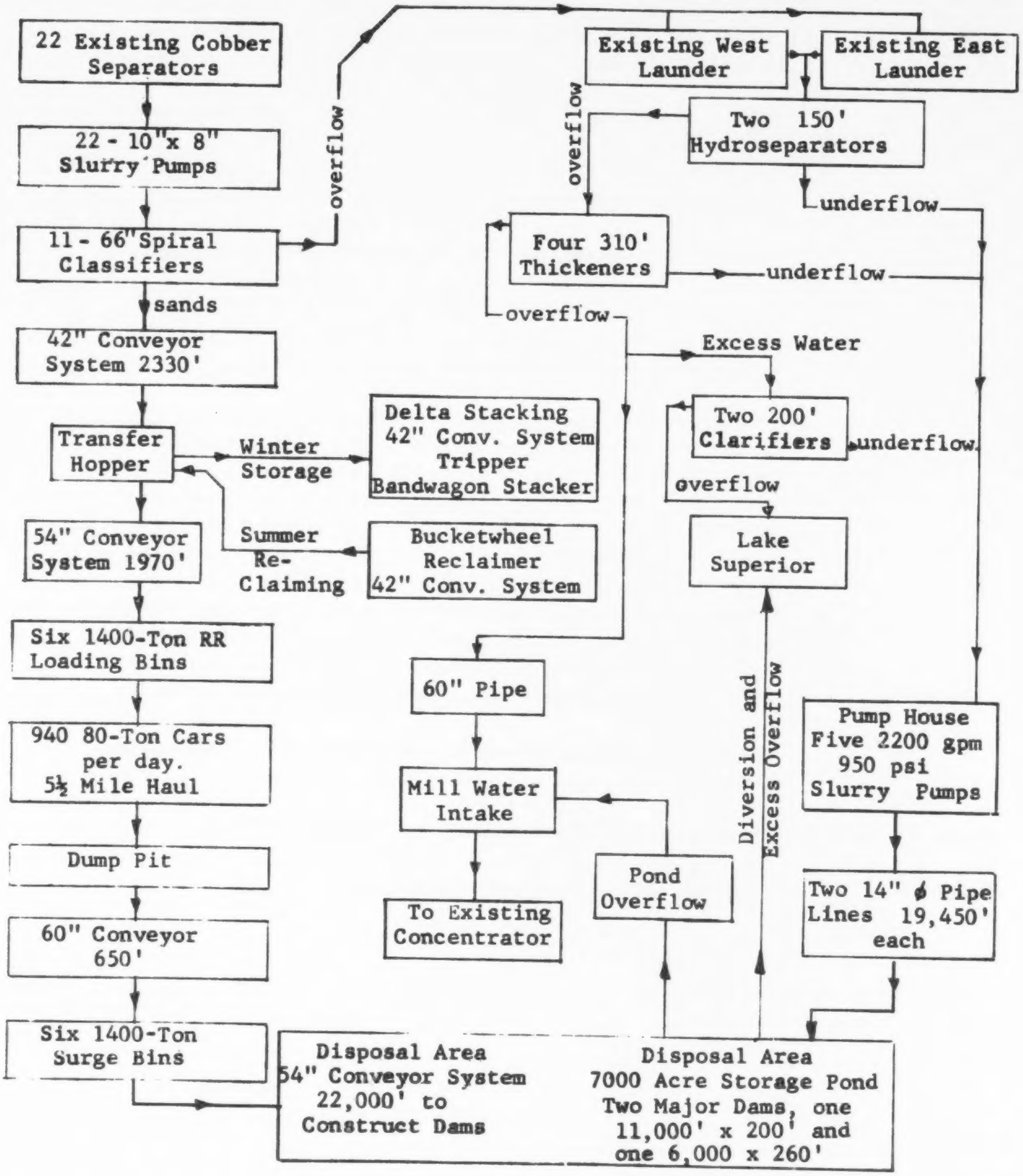
PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

FLOW SHEET

PROPOSAL #7

"COARSE TAILINGS RAIL-HAULED TO LAX LAKE AREA SUMMER MONTHS ONLY"


22 Existing Cobber Separators
22 - 10" x 8" Slurry Pumps
11 - 66" Spiral Classifiers
overflow
sands
42" Conveyor System 2330'
Transfer Hopper
Winter Storage
Delta Stacking 42" Conv. System Tripper Bandwagon Stacker
Summer Re-Claiming
Bucketwheel Reclaimer 42" Conv. System
54" Conveyor System 1970'
Six 1400-Ton RR Loading Bins
940 80-Ton Cars per day. 5½ Mile Haul
Dump Pit
60" Conveyor 650'
Six 1400-Ton Surge Bins
Existing West Launder
Existing East Launder
Two 150' Hydroseparators
overflow
underflow
Four 310' Thickeners
underflow
overflow
Excess Water
Two 200' Clarifiers
underflow
overflow
Lake Superior
60" Pipe
Mill Water Intake
To Existing Concentrator
Pond Overflow
Diversion and Excess Overflow
Pump House Five 2200 gpm 950 psi Slurry Pumps
Two 14" ϕ Pipe Lines 19,450' each
Disposal Area 54" Conveyor System 22,000' to Construct Dams
Disposal Area 7000 Acre Storage Pond Two Major Dams, one 11,000' x 200' and one 6,000 x 260'

PROPOSAL #8

"COARSE TAILINGS CONVEYED TO LAX LAKE AREA ALL YEAR"

ENGINEERING STUDY BY: Bechtel Corporation
50 Beale Street
San Francisco, California 94119

DESCRIPTION: Coarse tailings would be transported by belt conveyor to the Lax Lake area. Fine tailings would be thickened and pumped to a tailings basin also in the Lax Lake area.

Tailings from the cobber magnetic separators would be spiral classified into +35 mesh rake product and -35 mesh overflow fines. The rake product (about 50% of the total) would be belt-conveyed overland to the Lax Lake area and stacked. The spiral classifier overflow, combined with the balance of the fine tailings, would be fed into thickeners through existing launders. Thickener overflow would go back to the plant as process water. Underflow would be pumped to the Lax Lake area and impounded in the tailings basin. The tailings pond overflow would be returned to the plant and used as process water. Excess water would be clarified to less than 25 JTU and returned to Lake Superior.

PRELIMINARY EVALUATION: Partial estimated capital costs of $48,200,000 do not include items such as land acquistion; financing and interest; inflation prior to construction; spare parts; higher unit power cost due to additional power requirements; operating supplies; and mobile equipment other than railroad rolling stock.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 3,749,000
Depreciation	2,328,000
Interest	2,151,000
Total estimated average annual cost	$ 8,228,000

The conveyor system from the classifiers requires re-engineering for satisfactory operation.

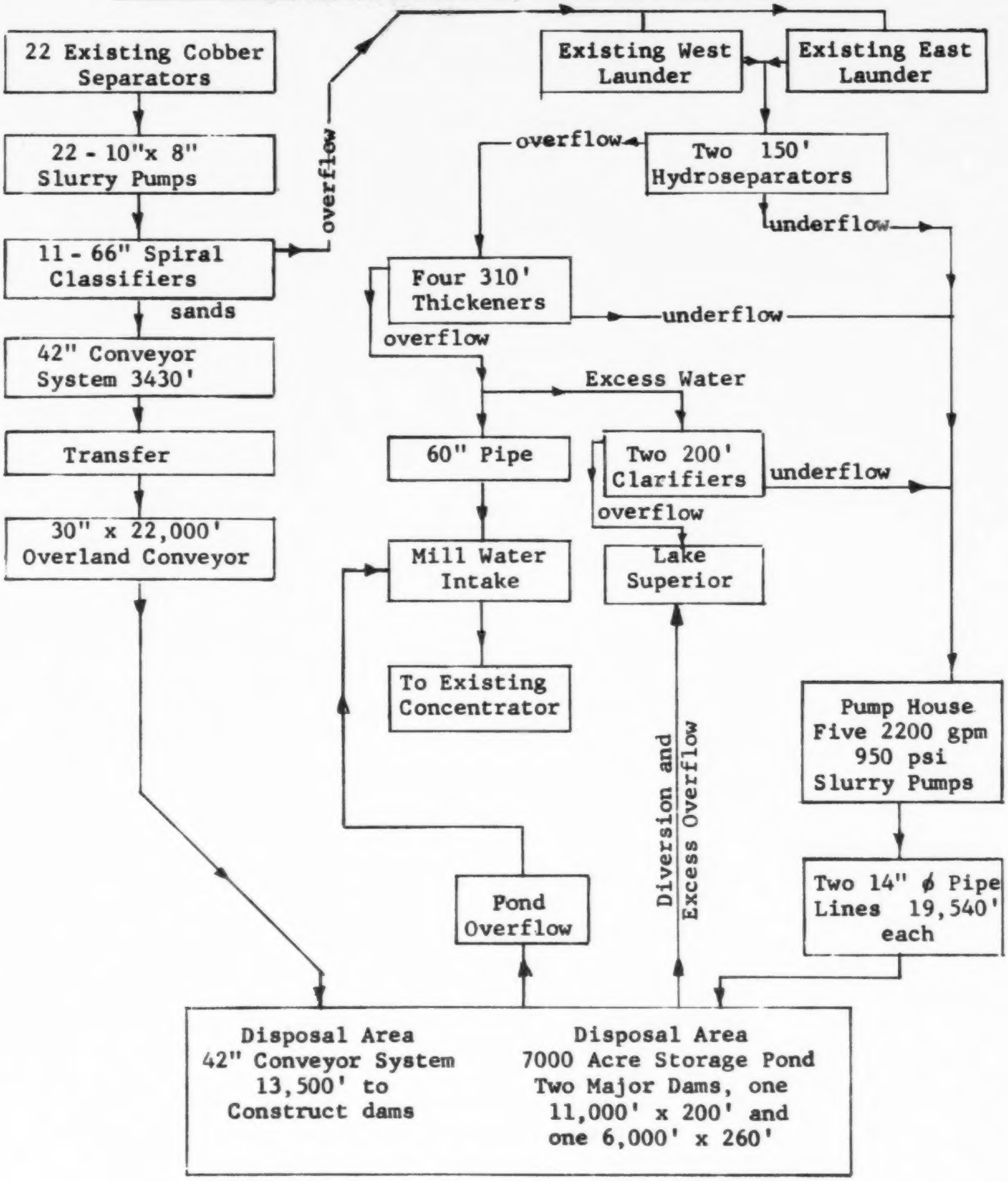
Proposal #8

This proposal does not appear to be acceptable from an environmental standpoint. The Lax Lake area would be destroyed for fishing, hunting, residential and resort purposes. Dust problems from blowing tailings would result as well. Fine tailings would enter Lake Superior from time to time via the Beaver River and Palisade Creek. Also, the tailings basin situated above the Beaver Bay-North Shore area could be a safety hazard.

PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

FLOW SHEET
PROPOSAL #8
"COARSE TAILINGS CONVEYED TO LAX LAKE AREA ALL YEAR"


22 Existing Cobber Separators
22 - 10"x 8" Slurry Pumps
11 - 66" Spiral Classifiers
overflow
sands
42" Conveyor System 3430'
Transfer
30" x 22,000' Overland Conveyor
Existing West Launder
Existing East Launder
overflow
Two 150' Hydroseparators
underflow
Four 310' Thickeners
underflow
overflow
Excess Water
60" Pipe
Two 200' Clarifiers
underflow
overflow
Mill Water Intake
Lake Superior
To Existing Concentrator
Pump House Five 2200 gpm 950 psi Slurry Pumps
Diversion and Excess Overflow
Two 14" ø Pipe Lines 19,540' each
Pond Overflow
Disposal Area 42" Conveyor System 13,500' to Construct dams
Disposal Area 7000 Acre Storage Pond Two Major Dams, one 11,000' x 200' and one 6,000' x 260'

PROPOSAL #9

"COARSE TAILINGS CONVEYED TO LAX LAKE AREA SUMMER MONTHS ONLY"

ENGINEERING STUDY BY:

Bechtel Corporation
50 Beale Street
San Francisco, California 94119

DESCRIPTION:

Coarse tailings would be conveyed during the summer months only by belt conveyors to the Lax Lake area. A stockpile of coarse tailings would be built at the plant site during the winter months. The fine tailings would be pumped to that area and impounded in a tailings basin.

Spiral classifiers would separate tailings into coarse (+35 mesh) and fine (-35 mesh) portions. The coarse, making up about half the total and containing about 18% moisture would be stockpiled on the delta during winter months, reclaimed during the summer and carried by conveyor belt to the Lax Lake area where it would be stacked. The fine portion would be fed into thickeners with the thickener overflow being sent back to the plant as process water. Thickener underflow--the fine portion of the tailings--would be pumped to the Lax Lake area and impounded behind dams built of coarse tailings. Tailings pond overflow would be returned to the plant as process water with the excess clarified to less than 25 JTU and returned to Lake Superior.

PRELIMINARY EVALUATION:

Partial estimates place the capital cost of such a proposal at more than $51,200,000 which does not include land acquistion; financial and interest charges; inflation prior to construction; spare parts; operating supplies; higher unit power cost due to additional power requirements; and mobile equipment other than railroad rolling stock.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 3,732,000
Depreciation	2,457,000
Interest	2,285,000
Total estimated average annual cost	$ 8,474,000

Proposal #9

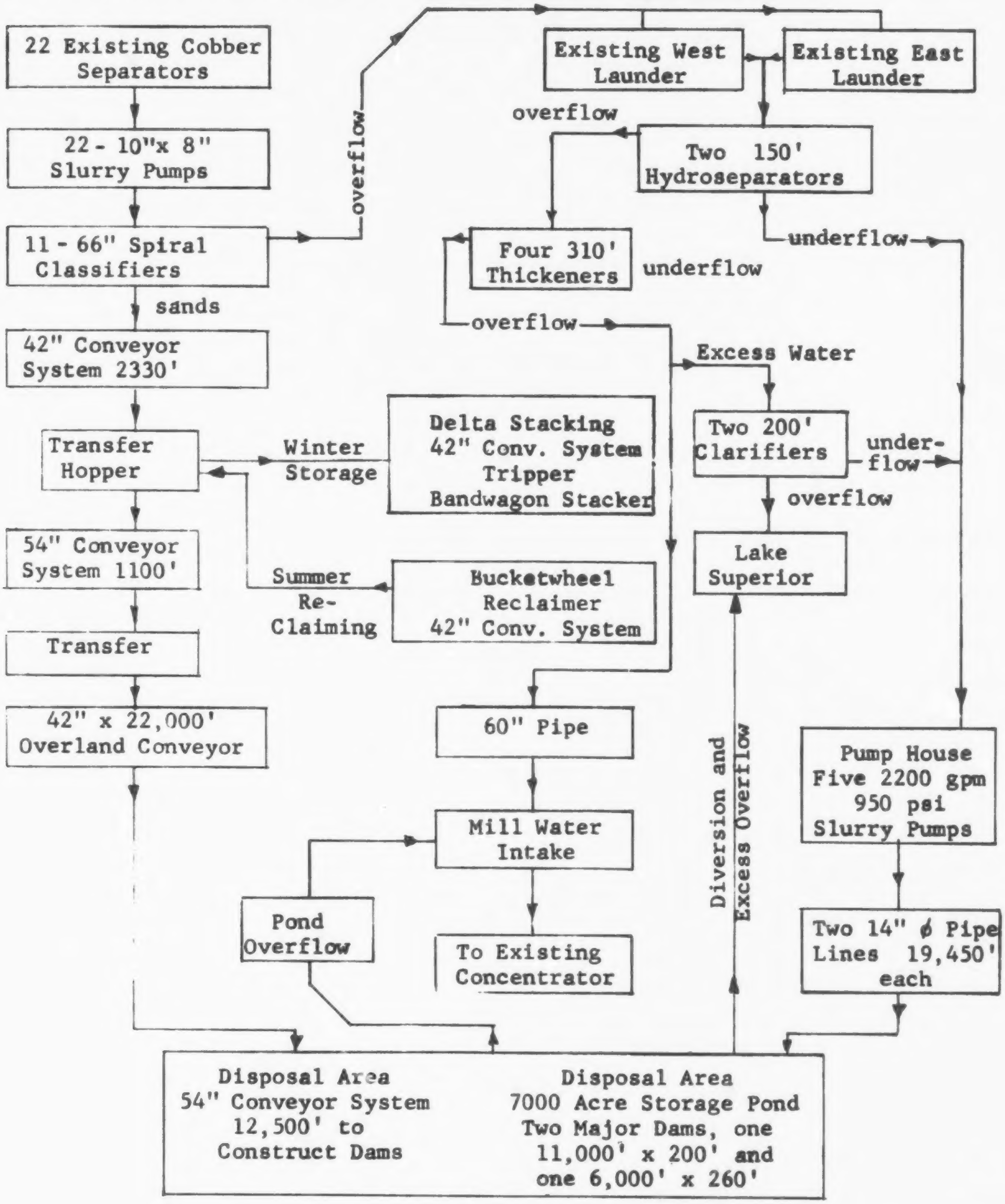
The conveyor system from the classifiers would have to be re-engineered before this system could be considered. Also, at 18% moisture, much of the delta stockpile would be frozen so deep that reclaiming would be difficult even in the summer months.

The proposal does not appear to be sound from an environmental standpoint. It would create serious new problems because the Lax Lake area--a prime resort, fishing, hunting and residential region--would be covered with tailings. Blowing dust would be a problem. Fine tailings would, from time to time, enter Lake Superior via the Beaver River and Palisade Creek. Also, the tailings basin could be a safety hazard to the village of Beaver Bay and the Beaver River valley.

Further, the proposal's feasibility from a technical standpoint, is questionable.

PROGRESS:	Preliminary engineering studies 100% complete.
TIMETABLE:	Not applicable; proposal abandoned.

FLOW SHEET
PROPOSAL #9
"COARSE TAILINGS CONVEYED TO LAX LAKE AREA SUMMER MONTHS ONLY"


22 Existing Cobber Separators
22 - 10"x 8" Slurry Pumps
11 - 66" Spiral Classifiers
overflow
sands
42" Conveyor System 2330'
Transfer Hopper
Winter Storage
Delta Stacking 42" Conv. System Tripper Bandwagon Stacker
Summer Re-Claiming
Bucketwheel Reclaimer 42" Conv. System
54" Conveyor System 1100'
Transfer
42" x 22,000' Overland Conveyor
Existing West Launder
Existing East Launder
overflow
Two 150' Hydroseparators
underflow
Four 310' Thickeners
underflow
overflow
Excess Water
Two 200' Clarifiers
under-flow
overflow
Lake Superior
60" Pipe
Mill Water Intake
Pond Overflow
To Existing Concentrator
Diversion and Excess Overflow
Pump House Five 2200 gpm 950 psi Slurry Pumps
Two 14" ϕ Pipe Lines 19,450' each
Disposal Area 54" Conveyor System 12,500' to Construct Dams
Disposal Area 7000 Acre Storage Pond Two Major Dams, one 11,000' x 200' and one 6,000' x 260'

Proposal #10

The environment of the region would be impaired by adoption of this proposal. Homes, both seasonal and year-round, as well as prime hunting, fishing, recreational and resort country would be covered by a large tailings basin. Lax Lake itself would cease to exist. Dust would be blown from the dry, exposed tailings and could affect a large area. Further, the Beaver Bay-North Shore area could be endangered by this tailings basin.

The transportation of 18% moisture tailings in winter weather would create many problems. The proposed electrically heated, insulated rail car is a new, untried concept. It would be necessary to conduct a sizable pilot test of these cars before this principle could be considered. Also the design of the conveyor system from the classifiers needs improvement.

The proposal's feasibility from a technical standpoint is questionable.

PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

PROPOSAL #10

"COARSE TAILINGS RAIL-HAULED TO MILE POST 32 ALL YEAR"

ENGINEERING STUDY BY: Bechtel Corporation
50 Beale Street
San Francisco, California 94119

DESCRIPTION: This proposal would require rail-hauling coarse tailings to a point 32 miles northwest of Reserve's plant.

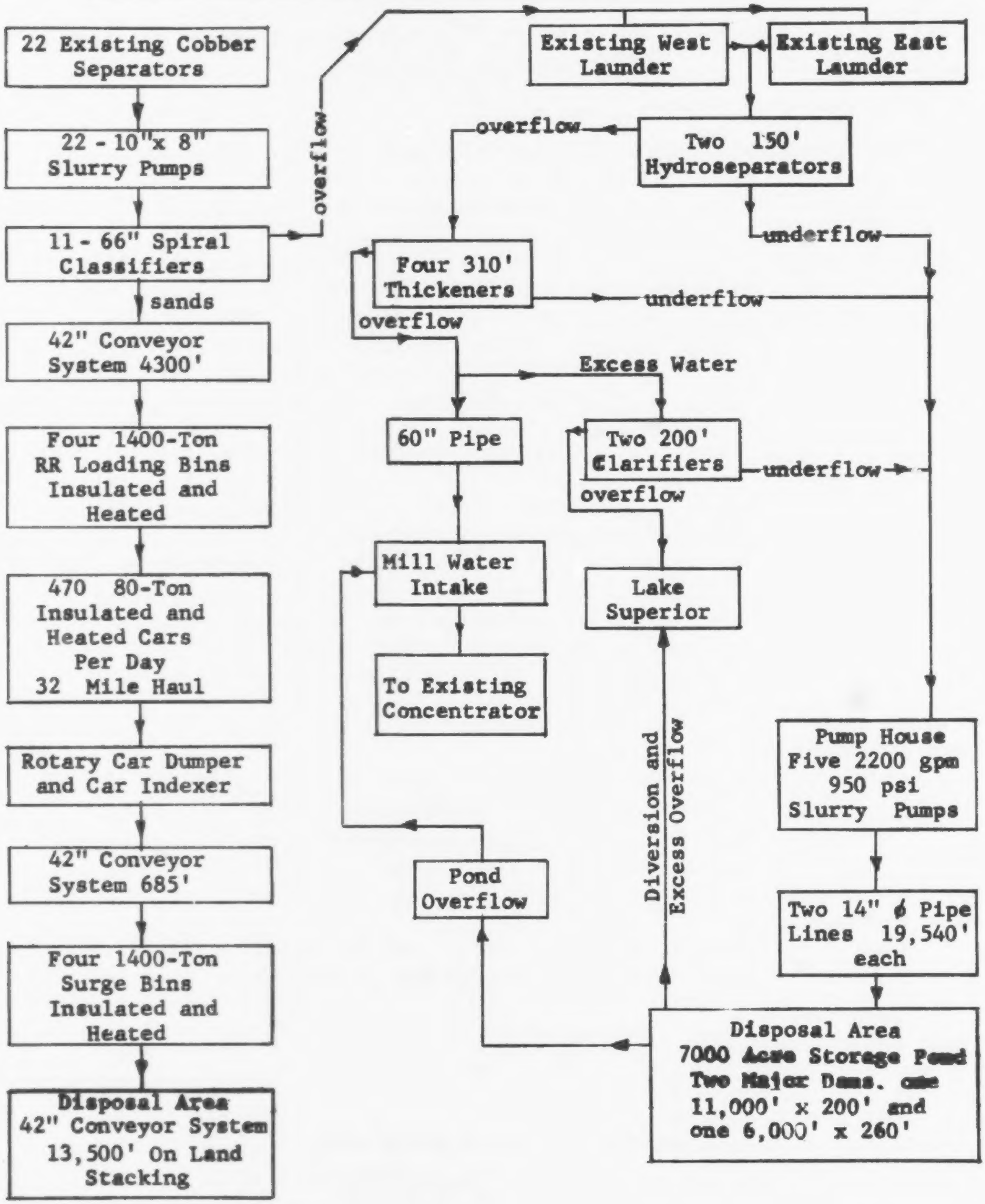
Spiral classifiers would separate cobber discharged tailings into a coarse (+35 mesh) product and a fine fraction of -35 mesh. The coarser fraction, about 50% of the total and containing about 18% moisture, would be conveyed to storage bins and then loaded into electrically heated, insulated railroad cars. The material would be rail-hauled to mile post 32 and spread on the ground by conventional stacking equipment. The spiral overflow combined with the balance of the fine tailings would be fed into thickeners through existing launders. Thickener overflow would be returned to the plant as process water. Underflow would be pumped to the Lax Lake area and impounded behind dams constructed from coarse tailings. Tailings pond overflow would be returned as process water to the plant and excess water would be clarified to less than 25 JTU and returned to Lake Superior.

PRELIMINARY EVALUATION: Partial estimates for capital costs are $46,200,000, not including land acquistion; financing and interest charges; inflation; spare parts; operating supplies; and mobile equipment other than railroad rolling stock. Also, no money is provided for an additional power line and the higher power costs that would be encountered.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 4,731,000
Depreciation	2,095,000
Interest	2,062,000
Total estimated average annual cost	$ 8,888,000

FLOW SHEET
PROPOSAL #10
"COARSE TAILINGS RAIL-HAULED TO MILE POST 32 ALL YEAR"


22 Existing Cobber Separators
22 - 10"x 8" Slurry Pumps
11 - 66" Spiral Classifiers
sands
42" Conveyor System 4300'
Four 1400-Ton RR Loading Bins Insulated and Heated
470 80-Ton Insulated and Heated Cars Per Day 32 Mile Haul
Rotary Car Dumper and Car Indexer
42" Conveyor System 685'
Four 1400-Ton Surge Bins Insulated and Heated
Disposal Area 42" Conveyor System 13,500' On Land Stacking
overflow
Existing West Launder
Existing East Launder
overflow
Two 150' Hydroseparators
underflow
Four 310' Thickeners
underflow
overflow
Excess Water
60" Pipe
Two 200' Clarifiers
underflow
overflow
Mill Water Intake
Lake Superior
To Existing Concentrator
Diversion and Excess Overflow
Pump House Five 2200 gpm 950 psi Slurry Pumps
Pond Overflow
Two 14" ϕ Pipe Lines 19,540' each
Disposal Area 7000 Acre Storage Pond Two Major Dams. one 11,000' x 200' and one 6,000' x 260'

PROPOSAL #11

"COARSE TAILINGS RAIL-HAULED TO MILE POST 32 SUMMER MONTHS ONLY"

ENGINEERING STUDY BY: Bechtel Corporation
50 Beale Street
San Francisco, California 94119

DESCRIPTION: Total tails would be divided by spiral classifiers into two portions of approximately equal volume; one made up of coarse material (+35 mesh), the other of fines. The coarse half, containing about 18% moisture, would be stockpiled on the delta during the winter. During the summer, this material would be reclaimed and rail-hauled to a point 32 miles northwest of the plant on Reserve's railroad and stacked on the ground.

Classifier overflow, combined with the balance of the fine tailings, would be thickened and pumped to the Lax Lake area where the material would be impounded in a tailings basin formed by dams made of coarse tailings. Thickener overflow and tailings pond overflow would be returned to the plant as process water. Excess water would be clarified to less than 25 JTU and returned to Lake Superior.

PRELIMINARY EVALUATION: Partial estimated capital costs of $54,300,000 do not include land acquisition; financing and interest costs; higher unit power cost due to additional power requirements; inflation; spare parts; operating supplies; mobile equipment.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$ 4,798,000
Depreciation	2,492,000
Interest	2,423,000
Total estimated average annual cost	$ 9,713,000

Proposal #11

The proposal would result in serious environmental problems because the Lax Lake area, a prime resort, fishing, hunting and residential region, would be the tailings basin site. Overflow of the tailings basin, from time to time, would carry fine tailings into Lake Superior via Beaver River and Palisade Creek. Blowing dust would be a problem. Also, the huge tailings basin perched above the residences of the Beaver River valley, including the Village of Beaver Bay, could be a safety hazard.

Technical problems as yet unsolved include: conveyor system from the classifiers is not satisfactory as designed; also at 18% moisture, much of the delta stockpile would be frozen so deep that reclaiming even in summer months would be difficult.

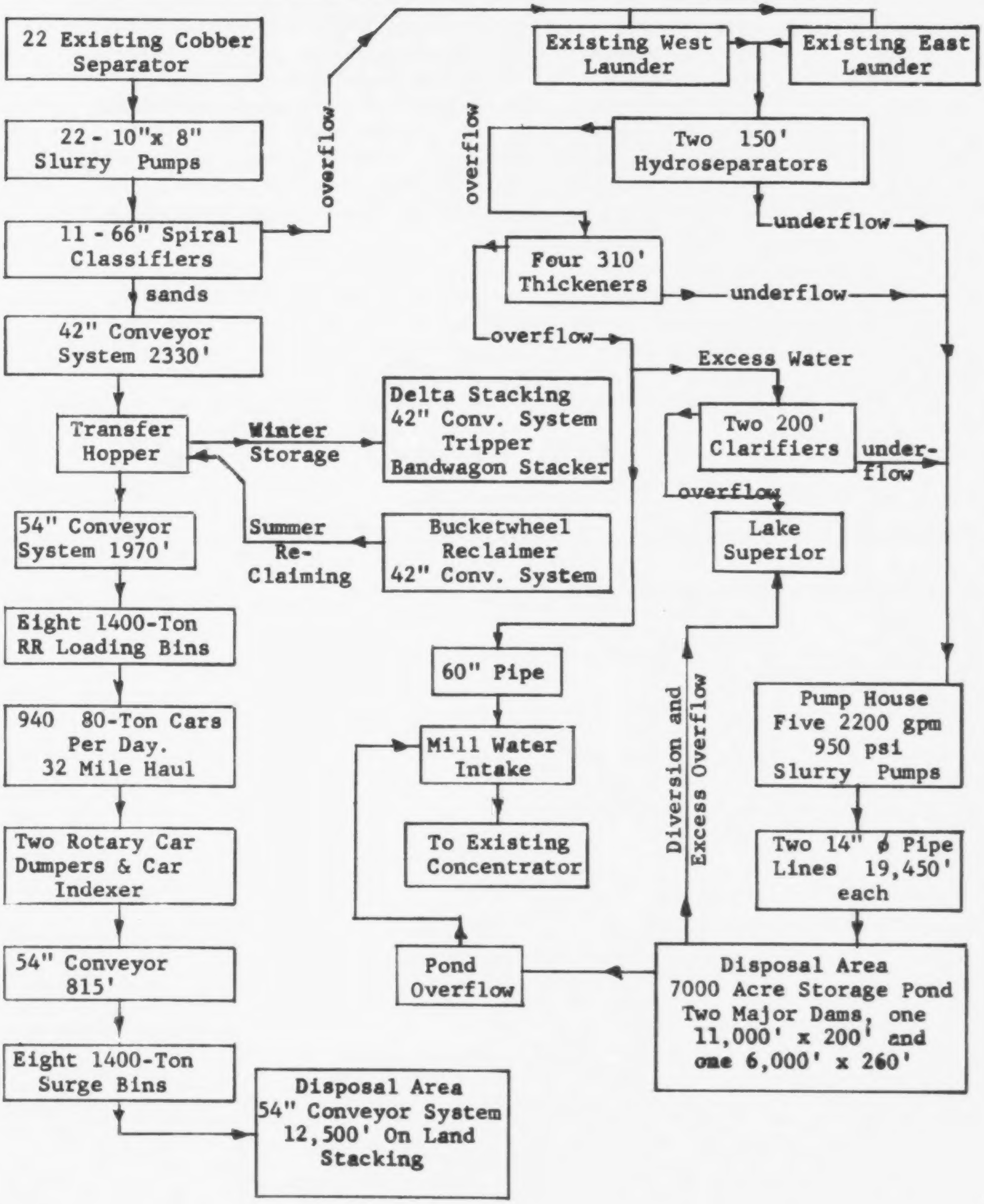
This proposal's feasibility from a technical standpoint is questionable.

PROGRESS:	Preliminary engineering studies 100% complete.
TIMETABLE:	Not applicable; proposal abandoned.

FLOW SHEET

PROPOSAL #11

"COARSE TAILINGS RAIL-HAULED TO MILE POST 32 SUMMER MONTHS ONLY"


22 Existing Cobber Separator
22 - 10"x 8" Slurry Pumps
11 - 66" Spiral Classifiers
overflow
sands
42" Conveyor System 2330'
Transfer Hopper
Winter Storage
Delta Stacking 42" Conv. System Tripper Bandwagon Stacker
Summer Re-Claiming
Bucketwheel Reclaimer 42" Conv. System
54" Conveyor System 1970'
Eight 1400-Ton RR Loading Bins
940 80-Ton Cars Per Day. 32 Mile Haul
Two Rotary Car Dumpers & Car Indexer
54" Conveyor 815'
Eight 1400-Ton Surge Bins
Disposal Area 54" Conveyor System 12,500' On Land Stacking
Existing West Launder
Existing East Launder
Two 150' Hydroseparators
overflow
underflow
Four 310' Thickeners
underflow
overflow
Excess Water
Two 200' Clarifiers
under-flow
overflow
Lake Superior
60" Pipe
Mill Water Intake
To Existing Concentrator
Diversion and Excess Overflow
Pump House Five 2200 gpm 950 psi Slurry Pumps
Two 14" ø Pipe Lines 19,450' each
Pond Overflow
Disposal Area 7000 Acre Storage Pond Two Major Dams, one 11,000' x 200' and one 6,000' x 260'

PROPOSAL #12

"FINE TAILINGS DISCHARGED THROUGH AN UNDERWATER DIFFUSER"

ENGINEERING STUDY BY: Engineering-Science, Inc.
150 East Foothill Boulevard
Arcadia, California 91006

DESCRIPTION: Fine tailings (-500 mesh) would be separated from the total by thickener-type equipment. Coarse tailings would be deposited on the delta. The fines, together with water overflow from the thickeners, would be pumped through a nine-foot diameter diffuser pipe into 300 feet or deeper water.

In this manner, a tailings beach would continue to grow because of coarse tailings. The fine tailings and approximately 300,000 gallons of water per minute would be pumped through the diffuser pipe which would extend into the 300-foot depth of water. The material from the pipe would have a turbidity of 2,560 JTU and would be essentially all -500 mesh or 25 micron size.

PRELIMINARY EVALUATION: No detailed feasibility study has been made to determine other equipment needed by this system. Therefore, the estimated cost of $10,000,000 for thickeners and diffuser is very incomplete.

Several alternative proposals are suggested to reduce the amount of water handled, allowing for smaller thickeners and outfall pipes and a reduced capital cost.

However, the proposal does not appear sound from a conservation standpoint. While it would eliminate or materially reduce the small amount of fine tailings which may be found in surface waters, it would result in a wide distribution of tailings on the lake bottom. Also, the temporary turbidity in deep waters would exceed the low turbidities existing in the present heavy density current.

No further engineering studies are planned.

PROGRESS: Preliminary engineering studies 100% complete.

TIMETABLE: Not applicable; proposal abandoned.

PROPOSAL #13

"LAKE SHORE TAILINGS POND"

ENGINEERING STUDY BY: Parsons-Jurden Corporation
26 Broadway
New York City, New York

DESCRIPTION: Under this proposal, a "dike" of coarse tailings would be built along the shore line. Its base would be the 100-foot deep contour line and would extend for 7,000 feet northeast of the present delta. This new "diked-in" area (the existing delta plus 7,000 feet of new delta, together with the natural shore up to 100 feet from Highway #61) would be used for deposit of our total tailings production behind the "dike" impoundment.

Tailings would be hydroseparated into coarse hydroseparator underflow (+150 mesh) and fine hydroseparator overflow (-150 mesh) fractions. The hydroseparator overflow would flow into thickeners. Thickener overflow would be returned to the plant as process water. The coarse fraction would be pumped to the delta edge to build a tailings dike by means of cyclone classifiers. The underflow (fines) would be pumped to the delta edge also building the dike by means of clones. Coarse tailings would be spigot-discharged on the lake side of the dike to build a spending beach to protect the dike from wave action. Likewise, spigots would discharge excess coarse tailings just inside the 100-foot lake bottom contour to build a 50-foot wide tailings dike in the water. When the dike is extended sufficiently, a tailings impoundment would be built over the remaining shallow water up to the lake shore, continuing on shore to within 100 feet of Highway #61. Decanting towers would drain the water from within this long tailings impoundment into the harbor for returning through existing pump system as process water.

PRELIMINARY EVALUATION: The proposal would completely eliminate the discharge of any tailings to the lake other than the coarse tailings (+150 mesh) required to build the dikes and spending beaches to protect the dikes.

Proposal #13

However, it presents some very undesirable features.

It would necessitate relocation of both the Silver Bay municipal sewage and water treatment plants.

It would be very unsightly despite our best efforts to plant the face of the dikes and the delta with grasses and trees. The impoundments would be very high and visible for miles along the shore.

After 30 years of operation, the basin would be 280 feet above the lake level. Also, only about half the fine tailings in the ponds would be covered with water at one time. This would result in severe and uncontrollable blowing dust over a wide area including the North Shore highway and the entire communities of Silver Bay, East Beaver Bay and Beaver Bay.

The estimated partial capital cost of this proposal is $27,449,000. The estimated cost of relocating the municipal sewage and water treatment plants is $3,920,000. The total estimated partial capital cost is $31,369,000. Those estimates do not include the cost of land acquisition; higher unit power cost due to additional power requirements; financing, interest and inflation until completion of construction.

The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

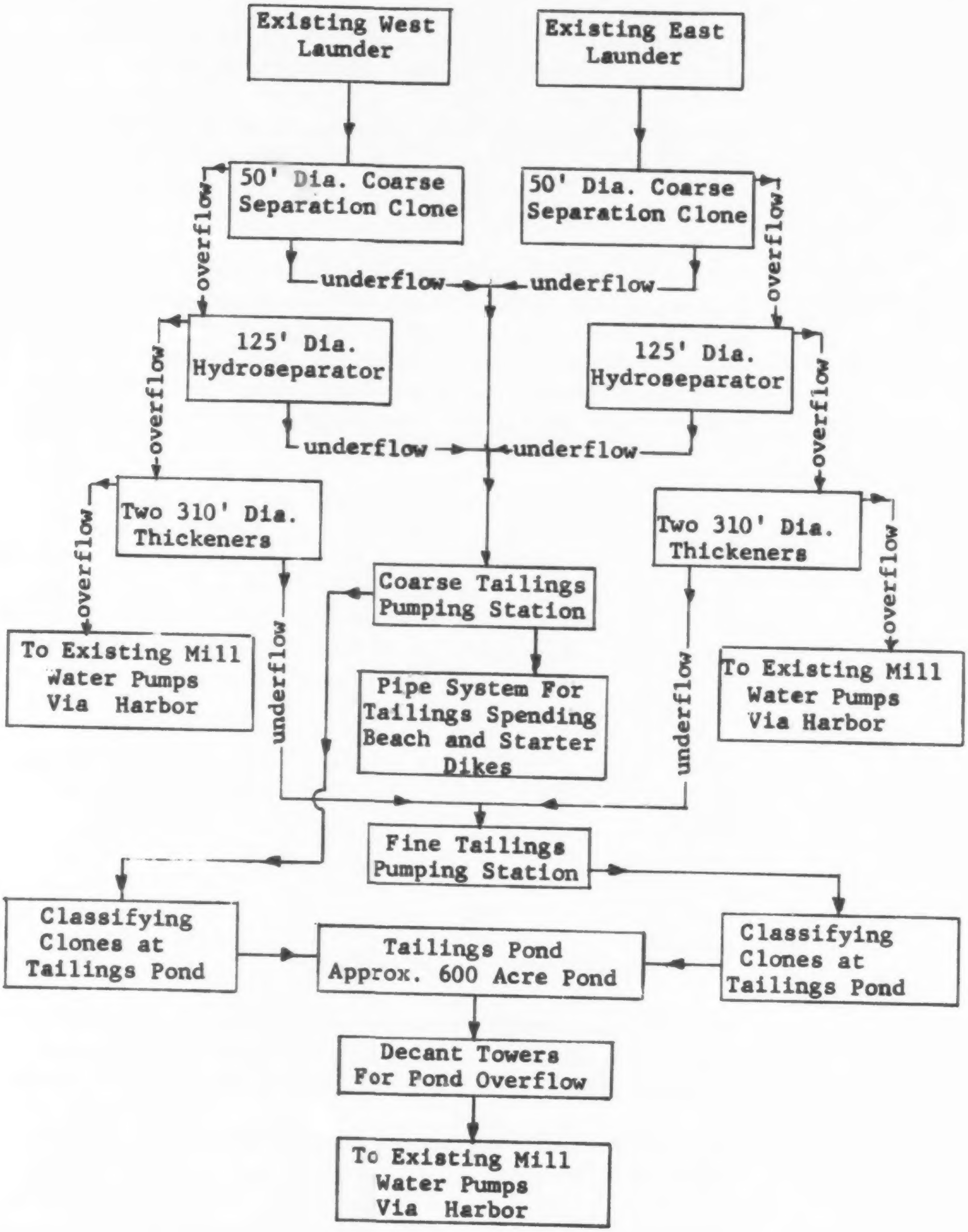
Direct operating	$2,899,500
Depreciation	1,178,000
Interest	1,400,000
Total estimated average annual cost	$5,477,500

The principle of high tailings basins built in areas of little or no water shed drainage should be investigated further. Also, means of dust control need to be studied.

PROGRESS: Preliminary engineering studies, as originally planned, 100% complete.

TIMETABLE: On April 3, a meeting with Parsons-Jurden was arranged for April 10, 1970, to discuss additional study on this basic principle.

FLOW SHEET
PROPOSAL #13
"LAKE SHORE TAILINGS POND"


Existing West Launder
Existing East Launder
50' Dia. Coarse Separation Clone
50' Dia. Coarse Separation Clone
overflow
underflow
underflow
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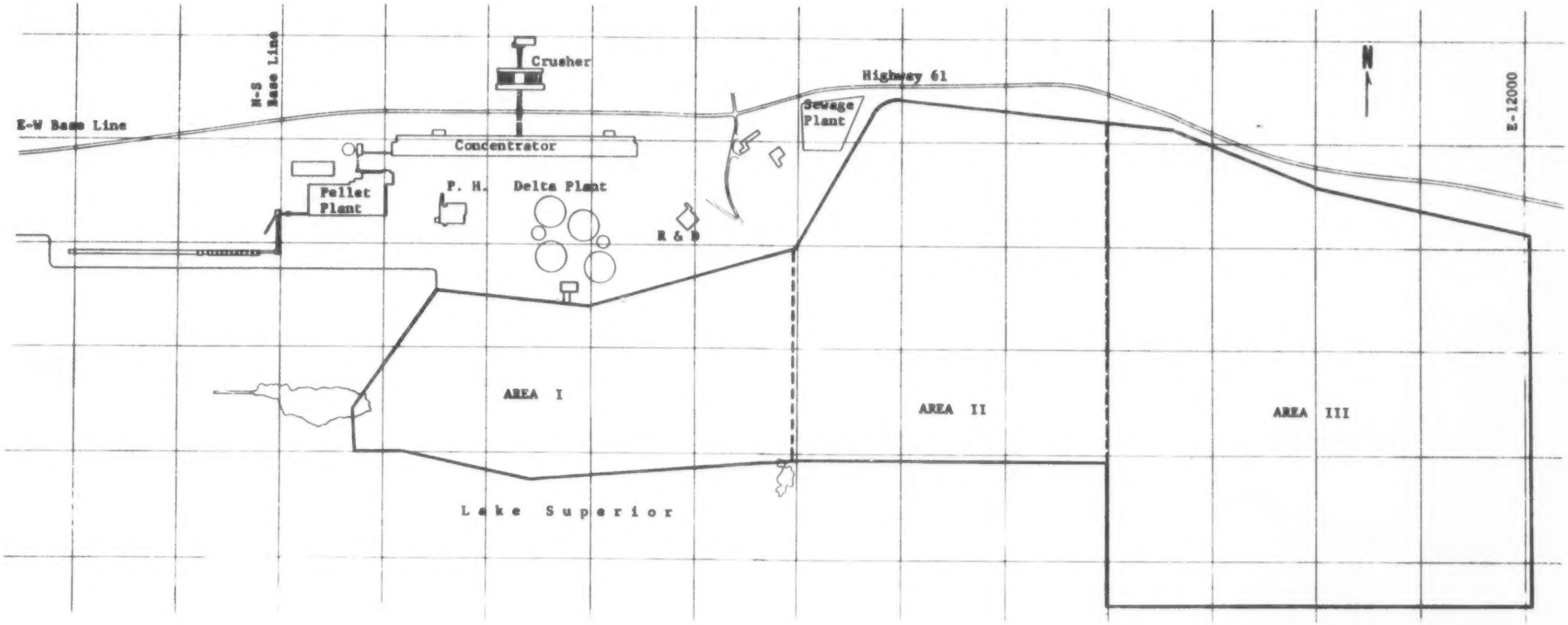
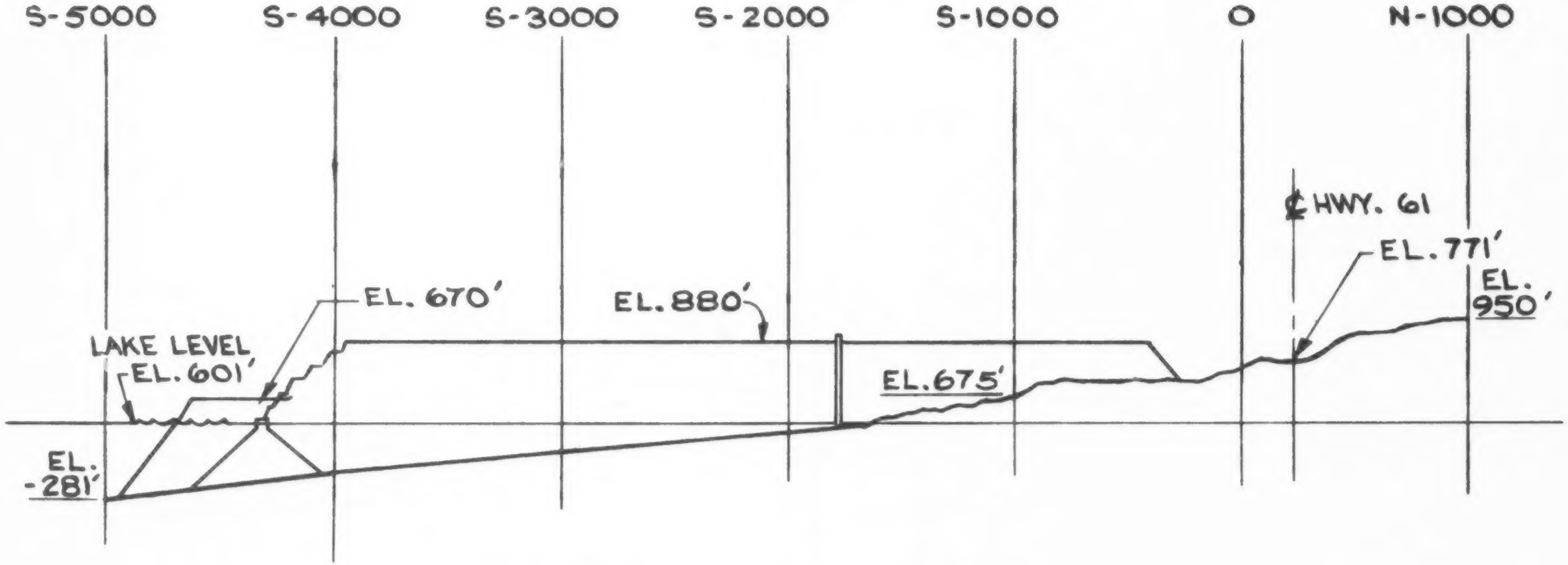
125' Dia. Hydroseparator
125' Dia. Hydroseparator
overflow
underflow
underflow
overflow
Two 310' Dia. Thickeners
Two 310' Dia. Thickeners
overflow
Coarse Tailings Pumping Station
overflow
To Existing Mill Water Pumps Via Harbor
underflow
Pipe System For Tailings Spending Beach and Starter Dikes
underflow
To Existing Mill Water Pumps Via Harbor
Fine Tailings Pumping Station
Classifying Clones at Tailings Pond
Tailings Pond Approx. 600 Acre Pond
Classifying Clones at Tailings Pond
Decant Towers For Pond Overflow
To Existing Mill Water Pumps Via Harbor


E-W Base Line
N-S Base Line
Crusher
Highway 61
Sewage Plant
E-12000
N
Concentrator
Pellet Plant
P. H.
Delta Plant
R & D
AREA I
AREA II
AREA III
Lake Superior

PLAN VIEW

PROPOSAL #13
LAKE SHORE TAILINGS POND


S-5000
S-4000
S-3000
S-2000
S-1000
0
N-1000
℄ HWY. 61
EL. 771'
EL. 950'
EL. 880'
EL. 670'
LAKE LEVEL
EL. 601'
EL. 675'
EL. -281'

CROSS SECTION @ E - 9000

FROM S-5000 TO N-1000

PROPOSAL #13

LAKE SHORE TAILINGS POND

PROPOSAL #14

"THICKENED COARSE TAILINGS DELTA"

ENGINEERING STUDY BY: Parsons-Jurden Corporation
26 Broadway
New York City, New York

DESCRIPTION: Coarse tailings would be piped in a manner designed to retain more tailings on the beach than current practice. Thickened fines (-150 mesh) would be pumped through a submerged pipe into 150-feet deep water.

Tailings would be hydroseparated into coarse (+150 mesh) and fine (-150 mesh) fractions with the fine fraction thickened and the overflow returned to the plant as process water. The thickened coarse tailings, hydroseparator underflow, would be pumped through ten or more pipes buried beneath the surface of the delta which would be built up to a level about 25 feet higher than the surface of the lake. The tailings would accumulate below each discharge until the discharge is nearly choked off. Pipes would then be extended another ten feet or more. By piping tailings to each end of the beach, the ends would be built up in advance of the center. Rock dikes then would be added at each end on top of the tailings, or the ends of the beach could be protected with pilings driven into the tailings. The fine tailings fraction would be pumped through a submerged pipe into 150 feet of water.

PRELIMINARY EVALUATION: More tailings would remain on the delta than at present--a material reduction (27%) of tailings discharged into the lake. All fines would be discharged below any surface-affecting thermocline, thereby eliminating or materially reducing the small amount of fines which may, under certain conditions, be found in surface waters. Also, by controlling the shape of the delta to a concave, the chances of fines being generated by wave action would be greatly reduced.

The entire delta could be landscaped to within 20 or 30 feet of the lake edge through continuous grass and tree plantings, enhancing the appearance of the delta. There would be no unsightly flow over the delta.

The partial estimated capital costs of $11,620,000 do not include higher unit power cost due to additional power requirements, or financing, interest and inflation costs until the completion of construction.

Proposal #14

The average annual costs over the next 20 years, except for escalation due to inflation are estimated to be as follows:

Direct operating	$1,185,850
Depreciation	519,000
Interest	519,000
Total estimated average annual cost	$2,228,850

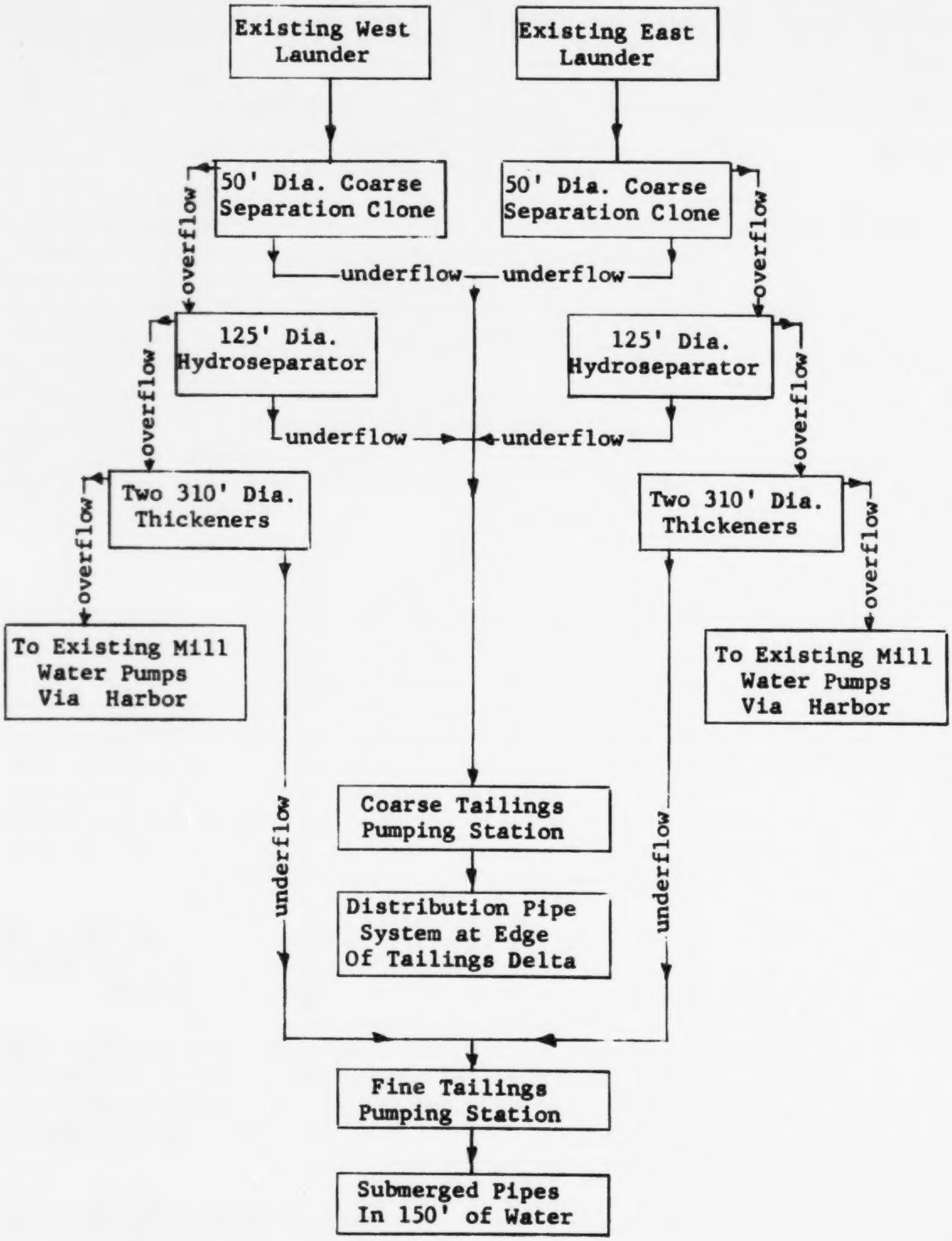
PROGRESS: Preliminary engineering 100% complete.

TIMETABLE: Ready for detailed engineering.

FLOW SHEET

PROPOSAL #14

"THICKENED COARSE TAILINGS DELTA"


Existing West Launder
Existing East Launder
50' Dia. Coarse Separation Clone
50' Dia. Coarse Separation Clone
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125' Dia. Hydroseparator
125' Dia. Hydroseparator
overflow
overflow
underflow
underflow
Two 310' Dia. Thickeners
Two 310' Dia. Thickeners
overflow
overflow
To Existing Mill Water Pumps Via Harbor
To Existing Mill Water Pumps Via Harbor
underflow
underflow
Coarse Tailings Pumping Station
Distribution Pipe System at Edge Of Tailings Delta
Fine Tailings Pumping Station
Submerged Pipes In 150' of Water

PROPOSAL #15

"UNDERWATER SAND REEF BENEFICIAL TO BOTTOM FAUNA AND FISH"

ENGINEERING STUDY BY: Parsons-Jurden Corporation
26 Broadway
New York City, New York

DESCRIPTION: Hydroseparators and thickeners would thicken tailings discharge to 40-60% solids. Thickener overflow would be recirculated to the plant as process water. Thickened tailings would be pumped through a number of pipes, the buoyancy of which is controlled to "float" them at 140 feet below the lake's surface when full of 40% solid slurry. When the lake bottom builds up to 150 feet in front of a pipe, water with sufficient trapped air would be pumped through it to cause that pipe to rise to the surface. An extension could then be added. Tailings would be pumped through it again causing it to sink back down to the 140-foot depth.

PRELIMINARY EVALUATION: Waters deeper than 400 feet are very sparse in bottom fauna on which fish feed. At depths of 100 to 150 feet, these bottom fauna are at their maximum population. Therefore, creating an underwater sand beach or reef at this depth would improve the food supply for valuable species of fish in the vicinity of Silver Bay. Such an area of plentiful fish food and excellent fishing sites is scarce along the Minnesota shore since the water reaches great depths so near the shore and because the lake bottom has little sand by comparison to the Wisconsin shore.

Further, this proposal would place all tailings below any surface-affecting thermocline so no tailings from Reserve's discharge should be found in any surface waters.

The edge of the present above-water delta would be stabilized with clusters of sheet piling cells to allow the planting of flowers, grasses and trees. No tailings would be seen entering the lake and tailings from the discharge would not be found in surface waters.

The partial estimated capital cost of $12,740,000 does not include higher unit power cost due to additional power requirements, or financing, interest and inflation costs to the completion of construction.

Proposal #15

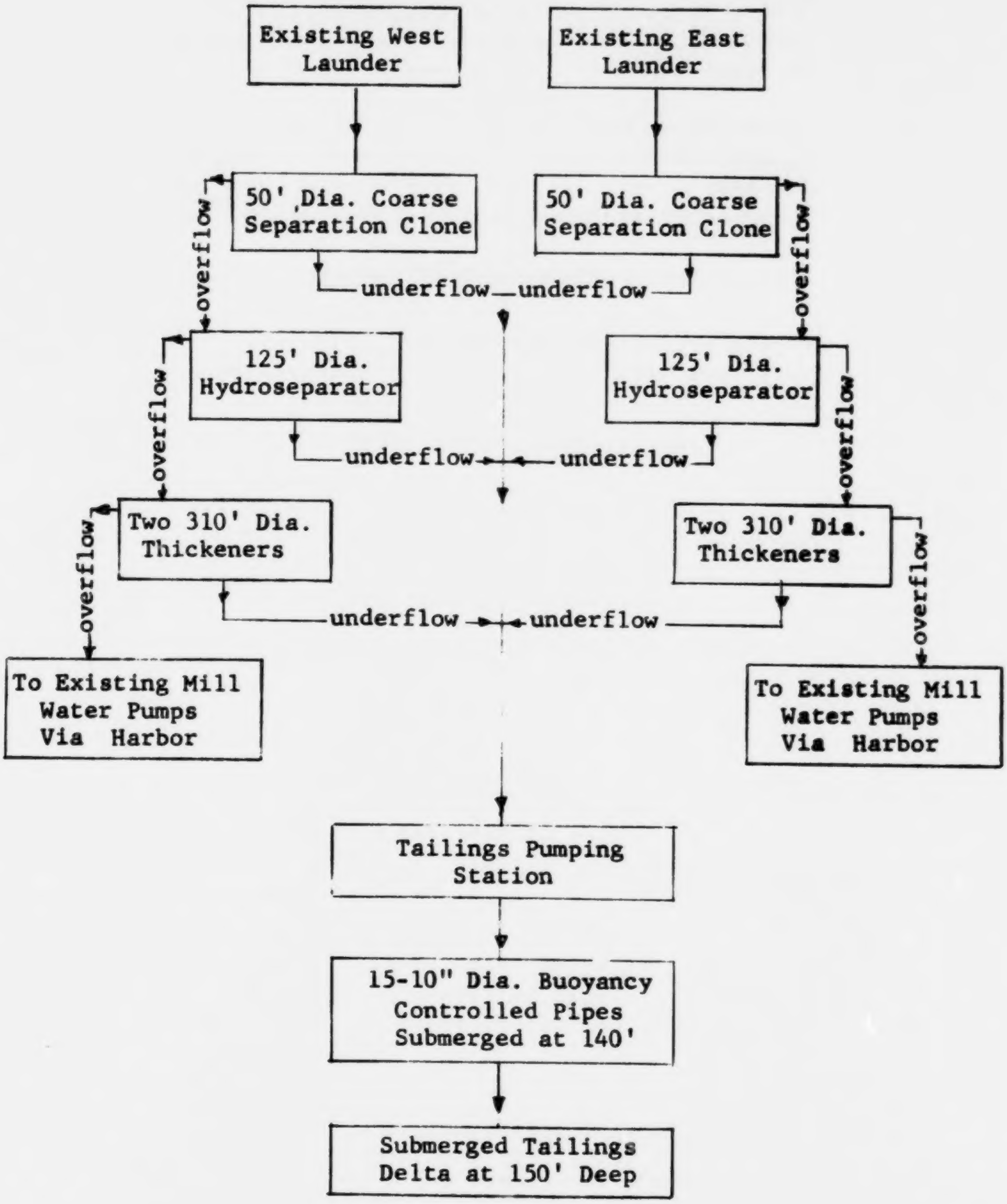
The average annual costs over the next 20 years, except for escalation due to inflation, are estimated to be as follows:

Direct operating	$1,123,000
Depreciation	532,000
Interest	569,000
Total estimated average annual cost	$2,224,000

PROGRESS: Preliminary engineering 100% complete.

TIMETABLE: Ready for detailed engineering.

FLOW SHEET
PROPOSAL #15
"UNDERWATER SAND REEF BENEFICIAL TO BOTTOM FAUNA AND FISH"


Existing West Launder
Existing East Launder
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50' Dia. Coarse Separation Clone
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125' Dia. Hydroseparator
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overflow
underflow
underflow
overflow
Two 310' Dia. Thickeners
Two 310' Dia. Thickeners
overflow
underflow
underflow
overflow
To Existing Mill Water Pumps Via Harbor
To Existing Mill Water Pumps Via Harbor
Tailings Pumping Station
15-10" Dia. Buoyancy Controlled Pipes Submerged at 140'
Submerged Tailings Delta at 150' Deep

PROPOSAL #16

"SMALL BOAT HARBOR AND SWIMMING AREA"

ENGINEERING STUDY BY: Engineering Department
Reserve Mining Company
Silver Bay, Minnesota

DESCRIPTION: This would be developed for public recreation west of the present west breakwater. Tailings would be used to build up the bottom of the bay to a 15-foot depth. A spending beach would be constructed on the east side of the breakwater. Tailings also would be used to make a sand beach at the shore.

The bay would be closed except for a small boat entry by a breakwater constructed from Mattson's Point to near Gull Island (see accompanying sketch). This shallow enclosed bay would be the only location along the Minnesota North Shore warm enough to permit swimming all summer long.

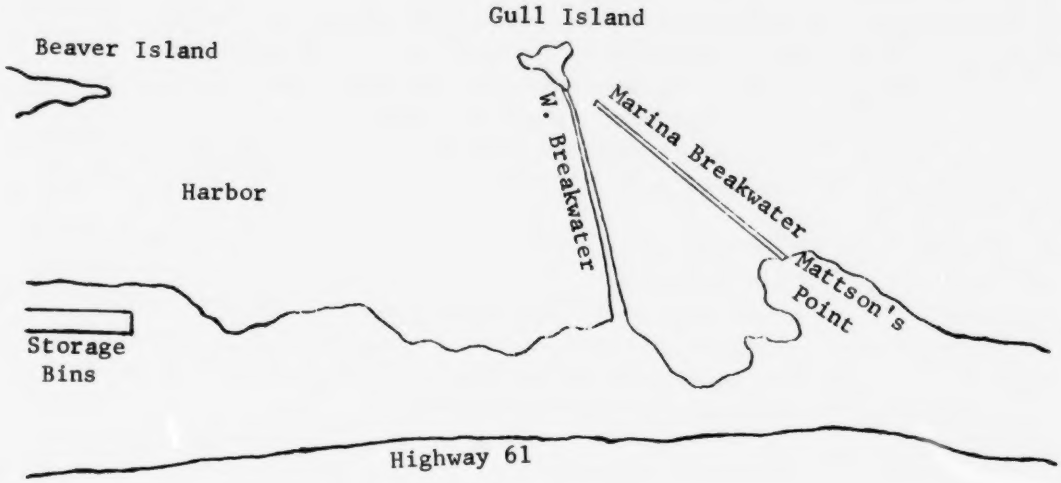
Boat launching ramps, docks, paved parking lots, paved roads, landscaping, etc., are needed to complete this project as a unique and much-needed park and recreational area.

PRELIMINARY EVALUATION: This will not dispose of much tailings, but is nevertheless a worthwhile project and constitutes another beneficial use of tailings.

Reserve's Engineering Department is making a preliminary study. It is expected that about 5,500,000 tons of tailings will be needed to raise the bottom of this bay to 15 feet and 90,000 cubic yards of rock will be needed to build the new breakwater.

NOTE: Since this idea was conceived, local, state and federal government agencies have announced a project somewhat similar to this, also based on the use of tailings. A news clipping is attached. It would appear more desirable for such a facility to be controlled and operated by the Village of Silver Bay rather than by Reserve Mining Company. Reserve will cooperate with the appropriate governmental agencies in every practicable way--including transfer of title to the property along the shore without cost.

Proposal #16


Gull Island
Beaver Island
Harbor
W. Breakwater
Marina Breakwater
Mattson's Point
Storage Bins
Highway 61

Area Interest Grows In Small Boat Harbors

Duluth News-Tribune 2-1-70

BY ARVID MORKEN

Of The News-Tribune Staff

Twenty - six years have passed since the U.S. Army Corps of Engineers recommended that small boat harbors be constructed at 30-mile intervals along the shores of Lake Superior.

Those 1944 documents have since gathered quite a bit of dust but have not been forgotten. The plan now appears to be a sound one; but two decades premature.

Because of a series of recent developments and coordinated efforts among several levels of government, it would not be unthinkable for small boat enthusiasts to consider the purchasing of new charts and the plotting of new courses out on that big lake, which has the coldest blue eyes in creation.

Local dollars toward the construction cost of recreational harbors were not made available for a considerable time after the Corps recommendations came along and most plans were filed in the bottom of desk drawers from Minnesota to Michigan. Meanwhile, the Corps classified its proposals as "inactive due to local interest."

But then people in Michigan created a state waterways commission which became an instrument to fund (among other projects) the small boat harbors urged by the Corps.

Minnesota, which had harbors at Duluth, Two Harbors and Grand Marais in 1944, was asked to provide new facilities at Knife River, Beaver Bay and the Poplar River. In the 20 years that followed, only the Knife River harbor became a reality.

Wisconsin, during the same period, added only Saxon to earlier small boat refuges in Superior, Port Wing, Cornucopia and Bayfield.

However, the change in Minnesota began two years ago when Gov. Harold LeVander blew dust off the Corps reports and looked for ways to implement the recommendations. More bottom drawers were emptied and state legislators were soon studying the 1944 proposals with village officials. More impetus came from John B. Arnold of Duluth after LeVander appointed him as his representative to the Upper Great Lakes Regional Commission.

"I'm glad the state is taking interest in our report," a Duluth spokesman for the Corps commented last week, "because those people down in Michigan got quite a head start." He credited Arnold with providing "a big push" toward the proposed network of harbors approximately every 30 miles.

The chicken and egg situation that retarded construction of small boat facilities over the years has largely been overcome by these developments, harbor supporters say:

—Advent of Minnesota's Coho Salmon program;

—Lamprey control in Lake Superior and resurgence of lake trout;

—Increasing emphasis on recreational facilities to serve area citizens and larger numbers of tourists;

—Construction of an interstate highway system that will make possible the towing of pleasure craft to Lake Superior at highway speeds from throughout the state.

Another significant development occurred during the past legislative session when Minnesota lawmakers passed a bill authorizing the state to assume 50 per cent of the local costs in constructing harbors recommended by the Corps.

Passage of that bill not only spurred greater consideration toward harbor facilities at locations suggested by the Corps, it prompted new planning in communities which had docks for small boats before 1944.

Developments toward construction of marinas and public docking facilities taken at all Minnesota sites programmed for the harbor network are outlined in a report released earlier this month by Arnold for the three-state regional commission. They are as follows:

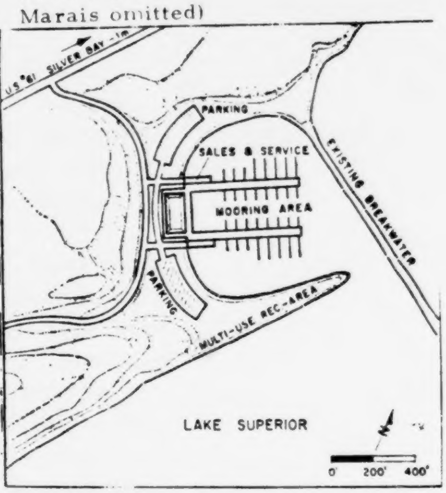
(Duluth-Superior, Knife River, Poplar River, Grand Marais omitted)

BEAVER BAY

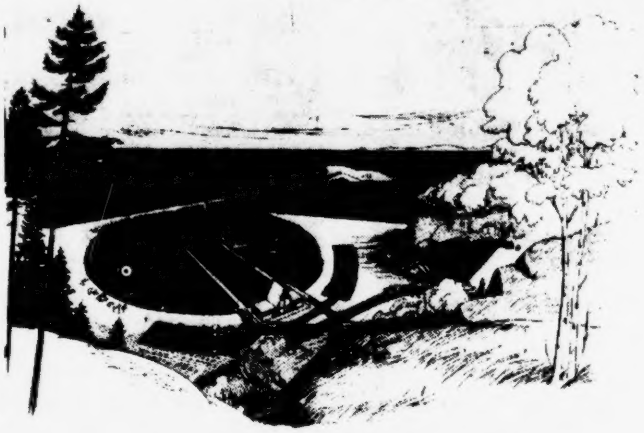
LeVander has asekd the Corps to reinstate Beaver Bay's recommendation for harbor construction, but to move the proposed site due to shoreline changes since 1944.

The project would be around a corner from the earlier site and would utilize the breakwater built by Reserve Mining Co., within the jurisdiction of the Village of Silver Bay.

The village has shown interest in the plan and has sent a resolution to the Corps indicating its intent to share local costs and provide information required to implement the 1944 recommendation. Preliminary drawings of the harbor plan have been offered and the commission describes cooperation between the governor's office, Corps and the village as "excellent and a fine example of inter-governmental relationships."



BEAVER BAY PLANS — This map shows proposed plans for small boat harbor at Beaver Bay.



HILLSIDE VIEW — The Beaver Bay harbor being planned may appear from a vantage point along Highway 61 as shown in the above sketch.

Reproduced from best available copy.

PROPOSAL #17

"DRY COBBING OF ROD MILL FEED"

ENGINEERING STUDY BY: Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION: Under this proposal, tailings would be dry cobbed from rod mill feed, reducing the discharge of total tails to the lake by as much as 30%.

Separation would be made using a permanent magnet, high intensity high RPM drum which was manufactured only recently. This test drum--which has, until only recently, been under study and evaluation by the University of Minnesota Mines Experiment Station--was installed in Reserve's pilot plant March 2nd. It began round-the-clock operation March 9th to obtain operating information and basic data needed to perform engineering feasibility studies.

PRELIMINARY EVALUATION: Preliminary laboratory-scale tests indicate that perhaps as much as 30% of the tailings can be removed before the material enters the rod mills and before any water is used in the process. The dry tailings removed would be both fine and coarse and would be deposited on land at some suitable location--perhaps even near the mine at Babbitt. Though only meager pilot plant data is available, Reserve has commissioned Trygve Hoff to make preliminary studies of several potential installations of this type of equipment and methods of disposing of the dry tailings. The results of the pilot plant work should produce a more accurate estimate of the amount of dry tailings that can be removed.

PROGRESS: 15 to 20% complete.

TIMETABLE: Preliminary engineering data and cost estimates expected in about 60 days.

PROPOSAL #18

"SCREENING ORE AHEAD OF THE ROD MILL"

ENGINEERING STUDY BY: Trygve Hoff & Associates
1922 East 107th Street
Cleveland, Ohio 44106

DESCRIPTION: This proposal would reduce the top particle size of the tailings, thereby improving the efficiency of tailings processing.

The -3/4 inch rock would be screened just ahead of the rod mill to separate the crude into fine and coarse fractions. The fine fraction would bypass the rod mill and go directly to the cobber magnetic separators. The coarse fraction would be fed into the rod mill. Since this will result in a material reduction of rod mill feed tonnage, more grinding will be done on less rock. Therefore, the top size of the rod mill discharge would be reduced from the present 5/8-inch size to possibly as low as about 10 mesh.

PRELIMINARY EVALUATION: Since top size of rod mill discharge establishes the top size of the total tailings, a reduction in the top size of tailings would reduce the amount of water used to flow the tailings through the launders. This reduction could amount to as much as 30%. Thus, the size or amount of the hydroseparating, thickening, clarifying and pumping equipment needed can be reduced in proportion to the water reduction. Also, the amount of flocculents or coagulants would be reduced in almost direct relationship to the amount of water reduction.

While this proposal would not be significant by itself, it would materially aid in the functioning of certain other proposals in a number of ways. For one example, it would permit the use of lower water velocities in transporting water-borne solid materials.

PROGRESS: A screen was installed in the pilot plant March 28, 1970, and a series of tests will be performed to determine the value of this system and to establish the best screen size.

TIMETABLE: Trygve Hoff is already making preliminary studies of possible installations. Pilot plant tests are expected to require approximately 90 days.

PROPOSAL #19

"BY-PRODUCT USE OF TAILINGS"

ENGINEERING STUDY BY: Arthur D. Little, Inc.
Acorn Park
Cambridge, Massachusetts 02140

DESCRIPTION: This proposal is concerned with possible practical uses of tailings.

PRELIMINARY EVALUATION: The entire sand and gravel market within economical lake or rail shipping distance of Silver Bay--including all metropolitan areas on the Great Lakes--will be studied. Such potential uses as road construction, island airports, building concrete, glass and cement industries, as well as the use of these heavy sands as filter media, will be evaluated.

The fact that these tailings have a higher specific gravity than many other sources of sand or gravel is a detriment to tailings for many uses. However, in filtering processes where the filter media is back-washed, this higher specific gravity is advantageous to tailings. One such filtering process is water filtering as performed by municipal water treatment plants. Reserve's tailings meet the American Water Works Association specifications for municipal water filter media.

Many of the potential commercial uses of tailings have been examined over the years by Reserve personnel and others and found to be impractical. This is the first time that expert marketing consultants such as Arthur D. Little have been retained to make such a survey.

PROGRESS: This study has only recently begun and little progress has been reported to date.

TIMETABLE: Oral report on preliminary engineering studies and partial cost estimates are expected within 90 days. Written report expected approximately one month later.

BOTTOM FAUNA STUDY
RESERVE MINING COMPANY - 1969

4-30-70

This study was designed so that analysis of variance could be used to establish:

1. An estimate of sampling variation.
2. If statistical differences exist between bottom organism populations in the different areas.
3. If statistical differences exist between sub-areas within the major areas.

This study consisted of examining five areas in the western end of Lake Superior for total organisms, Pontoporeia, oligochaeta, sphaeriidae, and chironomidae. Each area was broken down into five or six sub-areas and five samples were obtained from each sub-area with a Ponar dredge. All analyses were done in terms of organisms present per dredge. Appendix 1, pages 7-14, contains the sampling locations, the sampling procedures followed, and the raw data, 135 samples, obtained.

Areas No. 1 and 2 are located northeast of the plant site and did not contain a visible tailings layer. Areas No. 3 and 4 are located southwest of the plant site and contained a visible tailings layer. Area No. 5 is located a considerable distance to the southwest and did not contain a visible tailings layer.

Table 1, page 5, contains the average population for each type of bottom organism at each location. It also gives an estimate of the sampling variation for each type of bottom organism.

Appendix 2, pages 15-17, summarizes the analysis of variance results. Significant statistical differences were found to exist between the various areas for all types of bottom organisms. Significant statistical differences were also found to exist between the sub-areas within the major areas for all bottom organisms except oligochaeta. This indicates that a sample or group of samples from a single location cannot be considered representative of an entire area. To determine the true population of an area, both a sufficient number of sub-areas and a sufficient number of samples from each sub-area must be taken.

The means of the five major areas were examined using Tukey's test. Tukey's test provides a method of examining a group of means to determine similarities and differences. Table 2, page 6, summarizes the Tukey test results. These results are interpreted as follows.

736

1. All areas are somewhat different in populations of the types of bottom organisms. No two areas can be considered entirely similar. However, Areas No. 1 through 4 lying in the range 11 miles northeast of the plant site to 11 miles southwest of the plant site have some similarities in population of types. Area No. 5 which is 30 miles southwest of the plant site is distinctly different and is characterized by a lower population of types of bottom organisms.

2. In general, Areas 1 and 5 have the lowest populations of the various bottom organisms. Neither of these areas contain visible tailings.

3. Areas No. 1 and 3 are similar in total bottom fauna population. Also, Areas No. 2 and 4 are similar in total bottom fauna population, but they are different from Areas No. 1 and 3. Since Areas 3 and 4 contain tailings and Areas 1 and 2 do not contain visible tailings, the data indicates that there is no detectable effect of tailings on total bottom fauna populations in these areas. Because of insufficient data, the similarities or differences of Pontoporeia could not be determined.

4. Statistically, Area No. 4 which contained tailings has the same Pontoporeia population as Areas No. 1 and 5, both of which did not contain visible tailings. On the other hand, Area No. 3, which contained the lowest Pontoporeia population, is not statistically different from Area 4, which contains tailings, and Area 5, which does not contain tailings. Superficially, the lower Pontoporeia population in Area 3 might be attributed to tailings, but other localized influences, such as the Beaver River or Village of Beaver Bay, must be considered.

5. Areas No. 2 and 3 are alike in oligochaeta population. Area No. 2 did not contain visible tailings, while Area No. 3 did. Areas No. 1 and 2, which do not contain visible tailings, differ from each other in oligochaeta population. Also, Areas No. 3 and 4, which contain tailings, differ from each other in oligochaeta population. Therefore, the natural variation in oligochaeta population is greater than any possible variation due to tailings.

6. Areas No. 1 through 4 are alike in their sphaeriidae population. This would indicate that tailings have no effect on the sphaeriidae.

7. Areas No. 1 and 2, which did not contain visible tailings, are alike in their chironomidae population. Areas No. 3 and 4, which contained tailings, are alike and highest in the chironomidae population.

An examination of the data indicated that the bottom organisms are generally uniformly distributed in Areas 3, 4 and 5, but that they were not uniformly distributed in Areas 1 and 2. This is determined by application of the x^2 test (see Appendix 3, page 18). The x^2 test tells how well an actual distribution fits a theoretical distribution.

Because the distribution in Areas 1 and 2 is not uniform makes an accurate determination of their population difficult to impossible. The uniform distribution of bottom fauna populations in the tailings area may reflect the effect of bottom uniformity due to tailings on the bottom fauna. This uniformity may cause the organisms to be more generally distributed instead of clustered. More data is necessary to study this possibility.

The following conclusions are made from the data collected and its statistical analysis:

1. There is no large area effect of tailings on the bottom fauna populations in western Lake Superior. The only effect which may exist is a very localized one on the Pontoporeia population. However, other factors exist, such as the Beaver River discharge and Village of Silver Bay, which could cause this effect. Further study of this area is necessary before definite conclusions can be made.

2. No consistant statistical differences exist between bottom fauna populations found in areas which have a visible layer of tailings and those which did not. Naturally occurring environmental factors apparently exert a greater influence on the numbers and kinds of bottom fauna organisms found in any given area than tailings do.

3. The data suggests that bottom fauna organisms are more uniformly distributed in areas covered by tailings than they are northeast of Silver Bay where there is no visible tailings layer.

4. Results of this study show that a realistic estimate of bottom fauna populations can only be established by the following sampling procedure:

    a. To determine the population of a small area (of the order of 100 yards square), several sub-areas must be sampled with a specific minimum number of samples obtained from each sub-area.

    b. To determine the population of a large area (of the order of one mile square), several small areas or sub-areas must be sampled according to preceding procedure.

The number of small areas required to represent a large area and the number of samples required to represent a small area can be estimated from the data developed in this study.

Application of Statistical Data to Previous Bottom Fauna Studies Conducted by Reserve

Reserve has conducted two bottom fauna studies prior to this statistical study; one in April, 1969, using a Peterson dredge and one in July, 1969, using a Poner dredge. Results of the April study were presented at the Conference on the Matter of Pollution of the Interstate Waters of the Lake Superior Basin held in Duluth, Minnesota, on May 13, 1969.

Variation data collected with the Ponar type dredge in the statistical study is no accurately applicable to the data collected in April with a Peterson dredge because the dredges are so different. The Ponar dredge, in addition to taking a somewhat smaller sample than the Peterson, has many structural refinements that make it a more reliable device for securing representative bottom fauna samples.

Bottom fauna data derived from the statistical study is now being applied to data obtained in the July, 1969, bottom fauna study.

To date, all bottom fauna studies conducted by Reserve during 1969 are 95% complete. None of these studies, however, have secured sufficient data to make an accurate estimate of bottom fauna populations along the North Shore, much less determine what factors influence these populations.

TABLE 1

Average for Each Type of Bottom Organism at Each Location and Estimate of Experimental Error for Each Type of Bottom Organism

Area No.	Location	Total Organisms	Pontoporeia	Oligochaeta	Sphaeriidae	Chironomidae
1	11.0 mi. N.E. plant site	83.90	41.53	16.93	18.50	6.93
2	6.0 mi. N.E. plant site	106.04	53.72	25.00	20.08	7.80
③	2.5 mi. S.W. plant site	85.56	22.92	24.04	20.68	17.96
④	11.0 mi. S.W. plant site	109.10	35.70	39.17	20.03	13.50
5	30.0 mi. S.W. plant site	58.24	34.56	8.28	13.84	1.56
	Variation between samples within subgroups	$(14.2)^2$	$(7.8)^2$	$(8.1)^2$	$(4.6)^2$	$(3.6)^2$
	Variation between subgroups within groups	$(8.0)^2$	$(7.2)^2$	N.S.	$(3.1)^2$	$(1.9)^2$
	Total variation within groups	$(16.3)^2$	$(12.6)^2$	$(8.1)^2$	$(5.5)^2$	$(4.1)^2$

○ Denotes area of the bottom that tailings were visible in the surface samples.

TABLE 2

Analysis of Bottom Fauna Populations of Areas Sampled Using Tukey's Test

Analysis	Comparison of Areas					Comparison of Values					Half Width of 95% Confidence Interval
Total Number of Organisms	5	1	③	2	④	58.2	83.9	85.6	106.0	109.1	16.3
Pontoporeia	③	5	④	1	2	22.9	34.6	35.7	41.5	53.7	14.5
Oligochaeta	5	1	③	2	④	8.3	16.9	24.0	25.0	39.2	6.1
Sphaeriidae	5	1	④	2	③	13.8	18.5	20.0	20.1	20.7	6.7
Chironomidae	5	1	2	④	③	1.6	6.9	7.8	13.5	18.0	4.5

Note: Areas or values underlined are statistically the same. A group is formed by comparing each value, starting with the lowest value, to all higher values.

○ Denotes area of the bottom that tailings were visible on the surface of the samples.

APPENDIX 1

BOTTOM FAUNA DATA COLLECTED FOR STATISTICAL ANALYSIS

Bottom fauna samples were collected along the North Shore of Lake Superior to determine the statistical significance of bottom fauna data collected by dredging. Five different locations were chosen for collecting these samples - 11.0 miles N.E. of the plant, 6.0 miles N. E. of the plant, 2.5 miles S.W. of the plant, 11.0 miles S.W. of the plant, and 30.0 miles S.W. of the plant. A total of 135 samples were collected from August 25, 1969, to October 20, 1969.

General Sampling Procedure:

At each of the five selected sampling locations a marker buoy was placed in the water and anchored at a depth of 200 feet. Sets of 5 individual dredge samples were then collected at 5 to 6 random locations around the buoy. Sampling points were located approximately 300 to 500 feet distance from the buoy. All samples were collected with a Ponar dredge.

Sample Nomenclature:

1. All samples collected at one specific location (i.e., 11.0 miles N. E. of plant, 6.0 miles N.E. of plant, etc.) are termed a group.

2. A set of 5 individual samples collected at random locations around the buoy are termed a subset.

3. Each individual sample collected as part of a subset is termed a sample.

Group numbers, location where each group was collected, number of subsets and samples in each subset of a group and the collection date of each group are listed below:

Group I - 11.0 miles N. E. of plant site - 1/4 mile off-shore
- 6 random subsets of 5 samples each
- collected on September 2, 1969.

Group II - 6.0 miles N.E. of plant site - 1/8 mile off-shore
- 5 random subsets of 5 samples each
- collected on September 16, 1969.

Group III - 2.5 miles S. W. of plant site - 1/4 mile off-shore
- 5 random subsets of 5 samples each
- collected on August 25, 1969

Group IV - 11.0 miles S. W. of plant site - 1/4 mile off-shore
- 6 random subsets of 5 samples each
- collected on September 3, 1969.

Group V - 30.0 miles S.W. of plant site - 1/4 mile off-shore
- 5 random subsets of 5 samples each
- collected on October 20, 1969.

APPENDIX 1 (Continued)

A tabular listing of all bottom fauna data collected for statistical analysis from August 25, 1969, to October 20, 1969, is given in Tables 1-5. Figure 1 is a map showing the approximate location where each sample group was collected.

APPENDIX 1

TABLE 1

Results of Group I Bottom Fauna Samples Collected 11.0 Miles N.E. of the Plant Site in 200 Feet of Water

Lab Sample Number	Subset and Sample Number	Total Number of Organisms Per Dredge*	Total Number of Pontoporeia Per Dredge	Total Number of Oligochaeta Per Dredge	Total Number of Sphaeriidae Per Dredge	Total Number of Chironomidae Per Dredge
69-1261	1-1	97	58	11	21	7
1262	1-2	105	58	6	35	6
1263	1-3	133	58	28	35	12
1264	1-4	77	44	18	12	3
1265	1-5	89	40	16	22	11
	Average	100.2	51.6	15.8	25.0	7.8
Std. Deviation		21.05	8.88	8.26	9.92	3.70
69-1266	2-1	85	39	29	13	4
1267	2-2	80	34	20	18	8
1268	2-3	74	22	33	14	5
1269	2-4	38	10	11	11	6
1270	2-5	72	32	9	29	2
	Average	69.8	27.4	20.4	17.0	5.0
Std. Deviation		18.50	11.52	10.62	7.18	2.24
69-1271	3-1	88	49	24	13	2
1272	3-2	87	52	11	21	3
1273	3-3	83	53	7	10	3
1274	3-4	70	49	5	15	1
1275	3-5	82	57	11	13	1
	Average	82.0	52.0	11.6	16.4	2.0
Std. Deviation		7.18	3.32	7.40	3.85	1.00
69-1276	4-1	103	56	30	11	6
1277	4-2	89	38	18	22	11
1278	4-3	92	42	16	21	13
1279	4-4	106	56	20	15	15
1280	4-5	97	47	23	19	8
	Average	97.4	47.8	21.4	17.6	10.6
Std. Deviation		7.16	8.14	5.46	4.56	3.65
69-1281	5-1	94	52	13	19	10
1282	5-2	69	43	17	4	5
1283	5-3	80	63	5	10	2
1284	5-4	57	23	17	9	8
1285	5-5	85	35	22	12	16
	Average	77.0	43.2	14.8	10.8	8.2
Std. Deviation		14.37	15.37	6.34	5.45	5.31
69-1286	6-1	61	21	18	20	2
1287	6-1	75	22	21	20	12
1288	6-3	62	12	16	26	8
1289	6-4	104	50	14	29	11
1290	6-5	83	31	19	26	7
	Average	77.0	27.2	17.6	24.2	8.0
Std. Deviation		17.68	14.41	2.70	4.02	3.94

*Total does not include numbers of _Mysis Relicta_

APPENDIX 1 (Continued)

TABLE 2

Results of Group II Bottom Fauna
Samples Collected 6.0 Miles N.E. of
the Plant Site in 200 Feet of Water

Lab Sample Number	Subset and Sample Number	Total Number of Organisms Per Dredge*	Total Number of Pontoporeia Per Dredge	Total Number of Oligochaeta Per Dredge	Total Number of Sphaeriidae Per Dredge	Total Number of Chironomidae Per Dredge
69-1321	1-1	67	32	22	13	4
1322	1-2	95	56	12	23	4
1323	1-3	136	59	39	24	14
1324	1-4	110	45	33	27	5
1325	1-5	127	53	28	26	20
	Average	107.0	49.0	26.8	22.6	9.4
Std. Deviation		27.36	10.84	10.38	5.59	7.27
69-1326	2-1	59	26	10	21	2
1327	2-2	80	24	31	20	5
1328	2-3	100	46	28	20	6
1329	2-4	100	41	25	27	7
1330	2-5	78	33	22	19	4
	Average	83.4	34.0	23.2	21.4	4.8
Std. Deviation		17.23	9.46	8.11	3.21	1.92
69-1331	3-1	114	62	27	19	6
1332	3-2	94	55	15	17	7
1333	3-3	152	60	60	16	16
1334	3-4	108	70	17	15	6
1335	3-5	92	47	16	18	11
	Average	112.0	58.8	27.0	17.0	9.2
Std. Deviation		24.21	8.53	19.07	1.58	4.32
69-1336	4-1	89	55	18	10	6
1337	4-2	140	62	47	26	5
1338	4-3	169	86	39	32	12
1339	4-4	116	70	16	27	3
1340	4-5	141	78	33	24	6
	Average	131.0	70.2	30.6	23.8	8.4
Std. Deviation		30.06	12.34	13.39	8.26	3.78
69-1341	5-1	106	69	18	14	5
1342	5-2	78	43	11	19	5
1343	5-3	95	61	19	12	3
1344	5-4	109	65	18	17	9
1345	5-5	96	45	21	16	14
	Average	96.8	56.6	17.4	15.6	7.2
Std. Deviation		12.15	11.87	3.78	2.70	4.38

*Total does not include numbers of *Mysis Relicta*

APPENDIX 1 (Continued)

TABLE 3

Results of Group III Bottom Fauna Samples Collected 2.5 Miles S.W. of the Plant Site in 200 Feet of Water

Lab Sample Number	Subset and Sample Number	Total Number of Organisms Per Dredge*	Total Number of Pontoporeia Per Dredge	Total Number of Oligochaeta Per Dredge	Total Number of Sphaeriidae Per Dredge	Total Number of Chironomidae Per Dredge
69-1236	1-1	81	17	24	7	33
1237	1-2	88	26	26	13	23
1238	1-3	76	24	24	13	15
1239	1-4	93	27	33	11	22
1240	1-5	91	21	29	20	19
	Average	85.8	23.0	27.2	12.8	22.4
	Std. Deviation	7.12	4.06	3.83	4.71	6.69
69-1241	2-1	84	23	15	18	28
1242	2-2	96	24	23	23	25
1243	2-3	89	25	20	24	20
1244	2-4	83	21	29	20	13
1245	2-5	83	19	30	18	17
	Average	87.0	22.4	23.4	20.6	20.6
	Std. Deviation	5.61	2.41	6.27	2.79	6.02
69-1246	3-1	86	23	28	20	15
1247	3-2	89	24	22	25	18
1248	3-3	79	19	23	24	13
1249	3-4	88	24	27	26	11
1250	3-5	91	24	32	22	14
	Average	86.6	22.8	26.4	23.4	14.2
	Std. Deviation	4.62	2.17	4.04	2.41	2.59
69-1251	4-1	84	18	22	27	18
1252	4-2	86	30	28	14	15
1253	4-3	78	25	21	22	10
1254	4-4	86	21	29	20	16
1255	4-5	83	21	23	29	10
	Average	83.4	23.0	24.6	22.4	13.8
	Std. Deviation	3.29	4.64	3.65	5.94	3.63
69-1256	5-1	88	25	22	23	18
1257	5-2	88	24	22	23	19
1258	5-3	74	23	11	24	16
1259	5-4	78	20	17	24	17
1260	5-5	97	25	21	27	24
	Average	85.0	23.4	18.6	24.2	18.8
	Std. Deviation	9.11	2.07	4.72	1.64	3.11

APPENDIX 1 (Continued)

TABLE 4

Results of Group IV Bottom Fauna
Samples Collected 11.0 Miles S.W. of
the Plant Site in 200 Feet of Water

Lab Sample Number	Subset and Sample Number	Total Number of Organisms Per Dredge*	Total Number of Pontoporeia Per Dredge	Total Number of Oligochaeta Per Dredge	Total Number of Sphaeriidae Per Dredge	Total Number of Chironomidae Per Dredge
69-1291	1-1	98	39	27	20	12
1292	1-2	109	35	40	19	15
1293	1-3	113	34	47	18	13
1294	1-4	103	31	43	18	11
1295	1-5	110	36	37	22	15
	Average	106.6	35.0	38.8	19.4	13.2
Std. Deviation		6.02	2.92	7.56	1.67	1.79
69-1296	2-1	120	38	46	23	13
1297	2-2	109	37	38	18	16
1298	2-3	102	33	15	19	15
1299	2-4	108	30	44	20	14
1300	2-5	111	32	43	22	14
	Average	110.0	34.0	37.2	20.4	14.4
Std. Deviation		6.52	3.39	12.76	2.07	1.14
69-1301	3-1	113	32	48	22	11
1302	3-2	104	35	39	17	13
1303	3-3	123	29	61	26	7
1304	3-4	108	36	42	20	10
1305	3-5	104	31	38	22	13
	Average	110.4	32.6	45.6	21.4	10.8
Std. Deviation		7.96	2.88	9.45	3.29	2.49
69-1306	4-1	92	36	26	19	11
1307	4-2	102	39	24	20	19
1308	4-3	88	36	24	16	12
1309	4-4	98	33	31	18	16
1310	4-5	102	37	33	19	13
	Average	96.4	36.2	27.6	18.4	14.2
Std. Deviation		6.23	2.17	4.16	1.52	3.27
69-1311	5-1	101	33	26	17	25
1312	5-2	124	35	54	23	12
1313	5-3	117	41	37	22	17
1314	5-4	123	36	52	21	14
1315	5-5	108	39	39	18	12
	Average	114.6	36.8	41.6	20.2	16.0
Std. Deviation		9.91	3.19	11.55	2.59	5.43
69-1316	6-1	128	44	54	15	15
1317	6-2	116	43	38	21	14
1318	6-3	118	36	49	20	13
1319	6-4	109	36	39	23	11
1320	6-5	112	39	41	23	9
	Average	116.6	39.6	44.2	20.4	12.4
Std. Deviation		7.27	3.78	6.98	3.29	2.41

*Total does not include numbers of Mysis Relicta

APPENDIX 1 (Continued)

TABLE 5

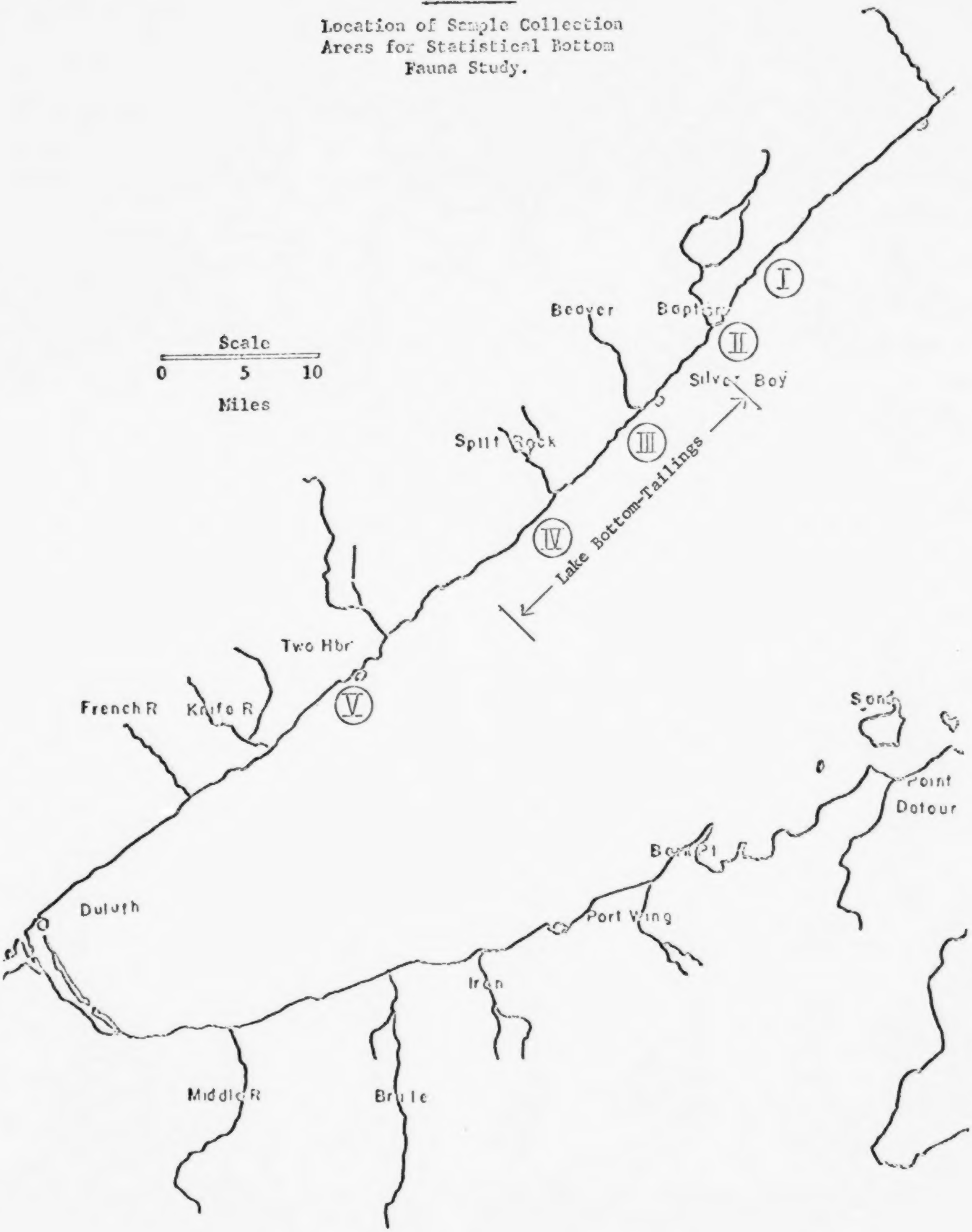
Results of Group V Bottom Fauna
Samples Collected 30.0 Miles S.W. of
the Plant Site in 200 Feet of Water

Lab Sample Number	Subset and Sample Number	Total Number of Organisms Per Dredge*	Total Number of Pontoporeia Per Dredge	Total Number of Oligochaeta Per Dredge	Total Number of Sphaeriidae Per Dredge	Total Number of Chironomidae Per Dredge
69-1346	1-1	62	37	10	11	4
1347	1-2	65	42	8	13	2
1345	1-3	50	30	6	11	3
1349	1-4	47	29	10	6	2
1350	1-5	57	38	4	12	3
	Average	56.2	35.2	7.6	10.6	2.8
Std. Deviation		7.66	5.54	2.61	2.70	0.84
69-1351	2-1	55	35	4	14	2
1352	2-2	44	21	9	11	3
1353	2-3	52	34	5	11	2
1354	2-4	88	56	10	16	6
1355	2-5	70	35	19	13	3
	Average	61.8	36.2	9.4	13.0	3.2
Std. Deviation		17.41	12.56	5.94	2.12	1.64
69-1356	3-1	44	32	4	6	2
1357	3-2	48	31	6	10	1
1358	3-3	93	43	22	27	1
1359	3-4	55	35	6	13	1
1360	3-5	55	35	2	17	1
	Average	59.0	35.2	8.0	14.6	1.2
Std. Deviation		19.58	4.71	8.00	8.02	0.45
69-1361	4-1	55	35	4	16	0
1362	4-2	53	30	10	12	1
1363	4-3	69	40	6	21	2
1364	4-4	47	28	7	12	0
1365	4-5	63	33	12	18	0
	Average	57.4	33.2	7.8	15.8	0.6
Std. Deviation		8.65	4.66	3.19	3.90	0.89
69-1366	5-1	56	30	8	18	0
1367	5-2	61	36	10	15	0
1368	5-3	52	31	10	11	0
1369	5-4	64	38	10	16	0
1370	5-5	51	30	5	16	0
	Average	56.8	33.0	8.6	15.2	0.0
Std. Deviation		5.63	3.74	2.19	2.59	0.0

*Total does not include numbers of *Mysis Relicta*

FIGURE 1

Location of Sample Collection Areas for Statistical Bottom Fauna Study.


Scale
0
5
10
Miles
Beaver
Baptism
I
II
Silver Bay
Split Rock
III
Lake Bottom-Tailings
IV
Two Hbr
V
French R
Knife R
Duluth
Sand
Point Detour
Bark Pt
Port Wing
Iron
Middle R
Brule

APPENDIX 2

Analysis of Variance Tables

1. Total Number of Organisms

Source of Variation	d.f.	Mean Square	F	Significance
Between areas	4	$11026.56 = \sigma_o^2 + 5\sigma_1^2 + 26.94\sigma_2^2$	21.2	1% level
Between sub-areas within areas	22	$519.94 = \sigma_o^2 + 5\sigma_1^2$	2.56	1% level
Within areas (between samples)	108	$202.63 = \sigma_o^2$		

$\sigma_o = 14.2$; $\sigma_1 = 8.0$; $\sigma_2 = 19.7$

2. Pontoporeia

Source of Variation	d.f.	Mean Square	F	Significance
Between areas	4	3171.01	9.87	1% level
Between subareas within areas	22	321.12	5.21	1% level
Within areas (between samples)	108	61.55		

$\sigma_o = 7.8$; $\sigma_1 = 7.2$; $\sigma_2 = 10.3$

3. Oligochaeta

Source of Variation	d.f.	Mean Square	F	Significance
Between areas	4	3622.01	37.52	1% level
Between sub-areas within areas	22	96.52	1.46	N.S. (>10% level)
Within areas (between samples)	108	65.89		

$\sigma_o = 8.1$; $\sigma_1 = 2.5$ (N.S.); $\sigma_2 = 11.4$

4. Sphaeriidae

Source of Variation	d.f.	Mean Square	F	Significance
Between areas	4	197.63	2.89	5% level
Between sub-areas within areas	22	68.30	3.28	1% level
Within areas (between samples)	108	20.76		

$\sigma_o = 4.6$; $\sigma_1 = 3.1$; $\sigma_2 = 2.2$

APPENDIX 2 (Continued)

Analysis of Variance Tables

5. Chironomidae

Source of Variation	d.f.	Mean Square	F	Significance
Between areas	4	1028.47	21.89	1% level
Between sub-areas within areas	22	32.25	2.43	1% level
Within areas (between samples)	108	13.22		

$\sigma_o = 3.6$; $\sigma_1 = 1.9$; $\sigma_2 = 6.1$

APPENDIX 2

Calculation of Average Number of Observations in Groups Required for Analysis of Variance

$N = 135$ = Total number of samples
$k = 5$ = Total number of areas
$R = 27$ = Total number of sub-areas

n_i = Number of samples in group i
n_{ij} = Number of samples in subgroup j of group i

$$\bar{n}_1 = \left\{N - \sum_{i-1}^{k} \left(\sum_{j=1}^{r_i} n_{ij}^2 / n_i\right)\right\} \Big/ (R-k)$$

$$= \left\{135 - \left(\frac{3 \times 5 \times 5^2}{25} + \frac{2 \times 6 \times 5^2}{30}\right)\right\} \Big/ (27-5)$$

$$\bar{n}_1 = 5$$

$$\bar{n}_2 = \left\{\sum_{i=1}^{k} \left(\sum_{j=1}^{r_i} n_{ij}^2 / n_i\right) - \sum_{i=1}^{k} \sum_{j=1}^{r_i} n_{ij}^2 / N\right\} \Big/ (k-1)$$

$$= \left\{25 - \left(\frac{5^2 \times 27}{135}\right)\right\} \Big/ (5-1)$$

$$\bar{n}_2 = 5$$

$$\bar{n}_3 = \left\{N^2 - \sum_{i=1}^{k} (n_i)^2\right\} \Big/ \left[(k-1) \quad N\right]$$

$$= \left\{135^2 - \left[(25^2 \times 3) + (30^2 \times 2)\right]\right\} \Big/ \left[(5-1)\ (135)\right]$$

$$\bar{n}_3 = 26.94$$

APPENDIX 3

χ^2 = Values of Bottom Fauna Data

Group	d.f.	Total Number of Organisms	Total Number of Pontoporeia	Total Number of Oligochaeta	Total Number of Sphaeriidae	Total Number of Chironomidae
1	24	68.89*	84.29*	76.36*	49.89*	39.58‡
2	20	96.85*	43.70*	108.02*	21.38	51.14*
3	20	9.22	9.21	18.31	16.18	22.80
4	24	12.05	6.41	50.98*	7.38	15.88
5	20	57.26*	27.75	58.05*	27.37	10.42

‡ Significant at 2.5% level

* Significant at 0.5% level

The value of χ^2 is given by $\chi^2 = \frac{(n-1)s^2}{\bar{x}}$ which is $\frac{(\text{deviation})^2}{\text{expected value}}$

Thus, χ^2 for a subgroup would be $\frac{(n_s - 1)\, s_s^2}{\bar{x}_s}$, where

n_s is the number of samples in the subgroup

s_s^2 is the variance of the subgroup data

$\bar{x}_s$ is the mean of the subgroup

For a group composed of k subgroups, χ^2 is given by

$$\chi^2 = \sum_{n=1}^{k} \frac{(n_s - 1)s^2}{\bar{x}_s}$$

The probability the χ^2 will exceed a given value is shown in the following table:

d.f.	2.5% level	0.5% level
20	34.2	40.0
24	39.4	45.6

MR. FRIDE: Thank you.

As you all know, the Lake Superior conference in Duluth on May 13, 14 and 15 resulted in substantial testimony being presented. I believe the record numbers about 856 pages and there were numerous exhibits and papers submitted.

Reserve Mining Company appeared during those proceedings and submitted evidence by nine witnesses, including scientists of national renown.

Reliance is placed on those statements and the evidence that was submitted at that time, which demonstrate, we believe, that the waste sand known as taconite tailings had no adverse effect on any beneficial use of Lake Superior.

At the executive session of the conference on September 30 and October 1 the announcement that preceded it was made that it was for the purpose of analyzing the record made at the May conference and that Reserve Mining Company, therefore, made no presentation at that time. Reserve has made some earlier comments with respect to the executive session. They are appended as a part of the statement that we have submitted here.

Mr. Kenneth Haley and I will make the presentation on behalf of the Reserve Mining Company, but we will not, in the interest of time, read the entire statements, but rather simply make comments as we go along.

On January 26th of 1970 Secretary of the Interior Hickel issued his summary of the conference. The recommendations made included the following:

"Reserve Mining Company be requested to undertake further engineering and economic studies relating to possible ways and means of reducing by the maximum practicable extent the discharge of tailings to Lake Superior and submit a report on progress to the Minnesota Pollution Control Agency and the conferees within six months of the date of issuance of the summary of conference by the Secretary. This report is to include a tentative timetable for necessary action. Lake sampling and effluent and operational information shall be furnished monthly by Reserve Mining Company to the Minnesota Pollution Control Agency. Reserve Mining Company also to inform the Minnesota Pollution Control Agency of the line of study they intend to pursue, and the Minnesota Agency will make that information available to the conferees."

Thus in essence the summary requests a report on progress to the Minnesota Pollution Control Agency and the conferees by July 26 of 1970.

Prior to the issuance of the Secretary's summary, Reserve announced the formation of an engineering task force to consider possible methods of altering or modifying the discharge to Lake Superior. It was to consider in its policy statement as announced such methods from the point of view of sound conservation practice, technical feasibility and economic feasibility.

Consistent with that announcement, the Secretary's recommendation, the company's long-standing policy of cooperation with appropriate governmental agencies, the company and its consultants are making an intensive investigation of possible modifications or alternations.

The Minnesota conferees supplied Reserve with a copy of Secretary Hickel's letter of January 26, 1970, wherein he stated in part:

"I recommend that a working copy of the progress report be ready by April 1, 1970, and that the final progress report be prepared as recommended within six months of the date of issuance of the Summary of the Conference by the Secretary of the Interior."

In that letter the Secretary also states that he has, and I quote:

"confidence that a meaningful working copy of the progress report can be completed before April 1 of 1970."

In accordance with that recommendation, Reserve Mining Company supplied the staff of the Minnesota Pollution Control Agency with a working copy of its progress report prior to April 1. Reserve was requested to formally present the working copy of its progress report to the Minnesota Agency at its regularly scheduled meeting on April 13 of 1970 and it did so. The company has also submitted to the Minnesota conferees for transmittal to the Federal and the Michigan and the Wisconsin conferees such a working copy of its progress report.

Mr. Chairman, I ask leave to file for the record the detailed engineering step reports which are summarized in the yellow book which you have before you. These were previously furnished to each of the conferees.

MR. STEIN: You want the detailed report in addition to the yellow book?

MR. FRIDE: In addition. They are a backup for the yellow book, Mr. Chairman.

MR. STEIN: Will we have copies of those?

MR. FRIDE: Yes, sir, they have all been distributed to the conferees previously by Mr. Badalich. I don't have them here in front of you. Those were all mailed because of their bulk.

MR. BADALICH: Mr. Chairman, I was furnished three sets of the complete proposals as indicated on the reporter's desk there and I sent one to Mr. Mayo; I sent one to Mr. Purdy; and I sent another one to Mr. Frangos, the complete set of engineering detailed studies.

MR. STEIN: I didn't get a set and it is going to be awfully hard on me to rule on this without seeing it. I guess you sent it to everyone else except the man who has to make the ruling.

MR. FRIDE: We will furnish you with a copy, Mr. Chairman.

MR. STEIN: I would like to see it so I can tell whether it should be an exhibit or be included in the record.

That is enough. We will include that as an exhibit. Thank you. (Laughter.)

MR. FRIDE: Your 4 o'clock departure would be a little bit delayed if we went through it all, Mr. Chairman.

MR. STEIN: Right.

(Which said detailed engineering reports are marked as Exhibit 1 and are on file at the FWQA Headquarters in Washington, D. C., with a copy on file at the FWQA Regional Office in Chicago, Illinois.)

MR. FRIDE: Long before the convening of the conference, Reserve had adopted a policy consistent with its permits and with its policy of operation of furnishing to the State agencies detailed information from its comprehensive lake studies program. This was consistent also with the Secretary's recommendation in the conference summary that "lake sampling and effluent operational information shall be furnished monthly by the Reserve Mining Company to the Minnesota Pollution Control Agency." It is my understanding that the Minnesota Agency has made that information available to Mr. Bryson as these reports were made.

Yesterday Dr. Mount suggested that he was interested in the results of the bottom fauna studies made by Reserve during this past summer. Reserve had previously reported to the Minnesota Pollution Control Agency with respect to the investigations being made in that connection. Reserve did not anticipate that at this reconvened session it would have an opportunity to present new data. However, in view of Dr. Mount's suggestion, we are submitting herewith a report of those recent studies and they have been filed with the other reports previously submitted to the Minnesota conferee.

Insofar as those reports are concerned and the detailed data that has been presented over the 14 years of this company's operation, we submit that the extensive surveillance and monitoring of Lake Superior during those 14 years of operation reveals no realistic basis for any conclusion that any material harm is being occasioned to any beneficial use of Lake Superior by Reserve's discharge. Reserve is advised that certain reports of technical studies were submitted by the National Water Quality Laboratory in Duluth to the conferees. These reports were not made available to Reserve until April 21, 1970. Obviously the time interval between the receipt of those reports and the reconvening of the conference is not sufficient to permit detailed analysis of the data presented and particularly a comparison between such data, other existing data from various sources, and the opinions expressed.

Reserve, Mr. Chairman, requests the conferees to afford it an opportunity to present such an analysis within a reasonable time to be fixed by the conferees.

Within the short time span described, however, certain observations can be made. In a number of respects the new reports confirm statements made on behalf of Reserve at the May session. For example, personnel of the laboratory now report that they have found cummingtonite in many Minnesota and Wisconsin streams, thus confirming Reserve's earlier testimony that when cummingtonite is detected in Lake Superior its source may be other than taconite tailings.

Such personnel also acknowledges that green water is also caused by sediments other than taconite tailings. There is no disagreement reflected by the fact that the green in the so-called green water is really not a true color but only an apparent color. We submit that such an apparent color has no significant effect on water quality.

There were some previous statements that have been made to the conferees to the effect that Reserve's discharge may violate certain water quality criteria, copper, zinc, and other metallic elements normally considered to be harmful pollutants, at certain concentrations. Dr. Glass's report concludes that the minute amounts of certain trace metals in the tailings, specifying copper, zinc, cadmium, sodium and iron, do not go into solution. This confirms Reserve's own data on the subject and we believe leaves the earlier statements of such alleged violations unsupported.

The basis for the statement that was contained in the conference summary of a deleterious effect of tailings which was included was apparently premised on the State of Minnesota Conservation Department report. We submit that when that report is analyzed that it does not support any such a conclusion.

This dealt with an alleged effect of tailings on certain bottom fauna. Reserve's technicians have secured hundreds of bottom samples and have classified and counted all available species of bottom fauna at varying depths over a wide area of the lake. This data, which we submit is far greater than that collected by the State or Federal agencies, certainly does not support any conclusion that tailings have had any adverse effect upon bottom fauna.

We were interested to note yesterday in Dr. Mount's presentation that he concluded, and I quote:

"In my judgment the effect of Reserve's discharge should be assessed in terms of altering the lake's appearance rather than the toxic effects on fish and fish food organisms or endangering water supplies."

Thus when you look at it, the principal concern expressed was apparently related to any contribution that Reserve's tailings might make to the so-called green water phenomenon.

Recognizing that his report also commented on the presence of green water in Wisconsin waters unrelated to tailings, it seems clear that we are now dealing with the rather subjective impression of what may be esthetically pleasing with no real evidence to support any widespread or significant areas of the lake with any change in apparent color due to tailings.

Reserve is pleased to note also that Dr. Mount confirmed Reserve's previous testimony when he reported, and I quote:

"One can see that the tailings are being deposited primarily in the deep trough off the Minnesota shore..."

Now, also Dr. Mount indicated that any realistic appraisal of possible effects of taconite tailings in Lake Superior must be equated with that body of water and with the concentration of tailings in it. He said, and I quote again:

"Bioassay data clearly suggests that direct adverse effects of the tailings on fishes and fish food organisms will not occur at the concentrations expected in the lake, except for local areas near the discharge and in the heavy density current."

As reflected in the Secretary's summary, in the Secretary's letter of January 26, Reserve was advised that the focus of that portion of the conferees' deliberations which relate to Reserve would involve the presentation of a working copy of its progress report of engineering and economic studies relating to possible ways and means of reducing, by the maximum practicable extent, the discharge of tailings to Lake Superior. In conformity therewith, Reserve's presentation will be substantially devoted to an explanation of the studies to date and, of course, to respond to any questions that the conferees may have in that connection. Inasmuch as the recent technical reports have been submitted to the conferees, Reserve will also take an opportunity of making some very brief preliminary comments relating to them for such consideration as the conferees may wish to give them, reserving, if we may, an opportunity to present a detailed analysis within a short time.

Mr. Kenneth Haley, who is Vice President and Manager of Research and Development for Reserve Mining Company and who is the Chairman of the Engineering Task Force, will present the working copy of the progress report to the conferees. Mr. Haley is an engineering graduate of Ohio State University. He has been associated with taconite processing since 1948 and he has been employed by Reserve Mining Company continuously since 1952.

Mr. Haley.

MR. STEIN: Just one moment, Mr. Fride. Let's see if there are any comments before we go on.

If there are none from the others, I have some. I wish I could share your optimism that you in your report and Dr. Mount's report completely coincided. I listened to Dr. Mount very carefully and I listened to you very carefully, and I still have some questions.

The first question is on cummingtonite. You say that cummingtonite is coming from some of the tributaries; it comes from various portions; therefore it is ubiquitous. As far as I am concerned--and I am not drawing any conclusions--but just summarizing what I am pretty sure I heard Dr. Mount say, Dr. Mount said he found cummingtonite in some of the tributaries, but it was in very very small amounts, as compared to what was coming out of Reserve. Checking these amounts he found that much larger quantities of cummingtonite were coming out of Reserve. Therefore, he regarded cummingtonite as a completely valid indicator in tracing the Reserve tailings.

You may have a difference with this, but I don't think, as far as I listened, that the Reserve people and Dr. Mount have come up with the same conclusion on cummingtonite. (Applause.)

MR. FRIDE: Mr. Chairman, may I respond to that?

MR. STEIN: Surely, go ahead.

MR. FRIDE: Mr. Chairman, I don't mean to suggest at all that Dr. Mount's analysis and statements and opinions are completely coincidental and completely identical with the statements which Reserve Mining Company has presented to this conference. I think that, as probably in many areas of technical competence, there are sometimes differences of viewpoint. I did mean to suggest--however, I think it is perhaps well to point out--that it is my recollection that back in May when this conference convened for the first time, that I think data that was then submitted to the conferees reflected that upon testing of many streams, the National Water Quality Laboratory was unable to detect any cummingtonite and, therefore, there was some doubt cast upon Reserve's statements on that premise that there were sources of cummingtonite to Lake Superior, other than that contained in taconite tailings, and that was the point that I was suggesting. In that connection, I think the new reports do reflect that there have been a number of samples which have been taken since the May conference which do, in fact, contain cummingtonite.

MR. STEIN: Right. Well, I think this goes both ways, Mr. Fride. In the report of those nine experts which you count--I guess since we got nine experts off the bench, we got all the reserves--they indicated that this cummingtonite was coming out of these various tributary streams and that Dr. Mount and his staff's analysis on using cummingtonite with a tracer was not a valid test. I think what Dr. Mount said this time, as I understand it, true, cummingtonite is available in relatively small amounts coming from these various streams, but he can detect a large amount of cummingtonite coming from Reserve; and he still regards this as a valid indicator.

I am not arguing one point or the other on that, but I think this is still the issue. If Reserve still thinks that cummingtonite is not a valid indicator, of course, that is its privilege. But from listening to Dr., Mount, he is, as far as I can tell, relying on cummingtonite very heavily as the indicator.

MR. FRIDE: Yes. I don't mean to suggest at all, Mr. Chairman, that cummingtonite under particular circumstances may not be a valid indicator of taconite tailings. I am not taking that posture, and I don't mean to suggest that, if that was the impression I left.

MR. STEIN: All right. Now, we can go to the next point, and this is this green water. I don't know, again, if we have an agreement. To my mind, from what Dr. Mount said and what you said, what harm does green water do? and is green water caused by the Reserve Mining operations? By the way, Dr. Mount, if I misstate anything, don't hesitate to come up here and correct me. As I understand his testimony Dr. Mount said that green water occurred in Lake Superior long before there were taconite tailings. However, as I understood him to say, he said, in numerous cases, taconite tailings were a cause of the green water, and the people in this area regard green water as esthetically undesirable. (Applause.)

You may argue with this, but this is what Dr. Mount said in his report.

MR. FRIDE: Let me just suggest this, if I might, Mr. Chairman, in that connection.

I think that the green water phenomenon is recognized, as I understand it, by all of the scientific and technical people as simply an index of light-reflect refraction which is caused or occasioned by sedimentation in the body of water which is being looked at.

Now, the point, I think, that we are suggesting for consideration of the conferees is the point that sedimentation in water may come from many different sources. Sometimes it may come from taconite tailings, and that is particularly true, I think, up around the area of discharge from Reserve Mining Company. I don't think there is any question that in that area taconite tailings do occasion green water.

But, I think it is also significant that long before this plant commenced operation, there were areas of green water in Lake Superior, as well as other bodies of water that Dr. Mount's reports indicate that when they have observed green water, in the Wisconsin area, for example, his tests reflect no taconite tailings. And I think the point is being made that if there is some green water, it is not always caused solely by taconite tailings.

And the point being also, and I think it is important, that green water in and of itself is simply an apparent color. If you held it up to the light in a glass here; if you tested it by any of the measurable means to detect any adverse effect on water quality--you would not find anything of any significance.

And I am simply suggesting, in the course of the statement which I made, that green water may be found in Lake Superior; it may be on occasions the taconite tailings and other natural sediments may be part of the reason for its existence. And as I said, that is particularly true in the area of Reserve's discharge.

MR. STEIN: Right. Well, again I think just to clarify the issue, this notion of whether you change the color or the clarity of the water, whether that is a change of any significance or not, of course, is a conclusion and probably a factual or legal conclusion. I recognize that Reserve might have its views on that. But, again, I think Dr. Mount has indicated that he had other views on that.

Here is the problem that I get. Dr. Mount never said, as I understand it, at the first session, that all the green water was caused by taconite tailings. But he does find a causal relationship between green water and some taconite tailings, and this is the burden of his testimony. So, again, I hope we are in agreement on what he said.

Let me get to the next point--and this may be the most significant one of all--and that is the premise that the Federal conclusions were based on a report of the Reserve Mining, or a mine report, or a university report. As I listened to Dr. Mount and as I understood his testimony, he said that the deleterious effects of the taconite wastes were based on the Federal report and Federal work. It stands on that. He found that the taconite wastes were biologically active, and they affected the clarity of the lake, certainly in the short term; and, in the long term, they would increasingly affect the clarity of the lake.

Now, again, as I understand Dr. Mount--and you can arrive at a conclusion whether this is substantial or not--but it is a question when people look at Lake Superior and look at one of the cleanest bodies of water in the world, whether in five years or ten years they want to look at water that is somewhat less clear, and if Dr. Mount finds a causal relation between the discharge which might make that less clear, do we have a problem?

Again I am not drawing conclusions. I am trying to state what I think Dr. Mount put forward in his statement.

MR. FRIDE: I am sure the Chairman's view and analysis of testimony is something that is very important to the conferees and I am sure to the audience. The point that was being made, however, was that in the April report submitted by the FWPCA entitled "An Appraisal of Pollution in the Lake Superior Basin," which I believe was introduced to the conferees and which formed a basis for its deliberations and presumably a subsequent basis for its conclusions, there was a statement in that report that tailings have a deleterious effect on a portion of the lake's ecology by reducing in a certain area the fish food organism that eventually came out to be identified as Pontoporeia. The only citation for any authority for that was, I believe, footnote 54, which was the Minnesota conservation study. And I submit that in that connection just on balance that when that report was submitted there must be taken into consideration the entire report; and that report said, on the theoretical basis only, there may be some adverse effect on this fish food scud known as Pontoporeia, but that in assessing the importance of that the conferees were suggested to take into consideration that they were talking about $6.55, I think, per acre of the value of that, and that was only a theoretical basis, and that was the maximum.

And so I think in balance that was repeated in the summary, if you will, that those exact words were used. And I think that the latest report, actually, and perhaps--I certainly don't want to get into too much of a dialogue here with you, Mr. Chairman, because I don't want to take up too much time before we get to the principal reason why we are here and that is to report on alternate methods--but the point, I think, significantly is that in the most recent reports there is no claimed adverse effect on Pontoporeia as a result of taconite tailings.

So I think, if you will, that much of the foundation of a deleterious effect really has been demonstrated with subsequent studies, and even with the studies that were then current, to be without perhaps too great a foundation.

MR. STEIN: I don't want to prolong this because if we are--obviously, as you well know, Mr. Fride, we are dealing with interstate effects.

MR. FRIDE: Yes, sir.

MR. STEIN: And I don't know that the interstate effects are based on an interference with fish food on this presumptive notion of pollution. If that was in effect, it was in effect presumably in the area of the plant, and that is a mine problem.

I am not sure we are not going at windmills or strawmen, because I don't think that this gets to the heart of the case. I think the heart of the case is whether materials from Reserve Mining and other sources alone or jointly or severally, in combination with other sources, get over to the Wisconsin State line and, perhaps, interfere with the clarity of the lake or have other effects on the lake in another State, so as to endanger health or welfare in that State, and without--I don't know that anyone drew an interstate effect on the basis of injury to fish food organisms at the first session or any other time.

MR. FRIDE: I know that with the Chairman's long experience in this field that he has stated very precisely what the issue is for the conferees, and that is whether or not there is from taconite tailings an adverse effect on the health or welfare of persons in another State other than Minnesota. We are certainly in agreement on that, Mr. Chairman.

I think that when one talks, however, of--you recall the conferees and the difficulty that was expressed with the word "presumptive;" but I think, again, the presumptive evidence of pollution has to be based on the context of what was the subject matter at that time.

The subject matter at that time was that there were certain cores that were reported to the conferees from Wisconsin waters which were analyzed by the laboratory and reported to contain cummingtonite, which then was followed by an indication that that cummingtonite represented tailings; and I think that a number of the conferees raised the question, well, you have sampled or you are reporting on a portion of the cores, how about the rest of the cores; and at that time, with the demands that were being placed on the laboratory, they didn't have those analyses ready.

Now, the point being that that is where the word "presumptive" came in, and it was only in that context, if my memory serves me correctly; and the "presumptive" was not presumptive pollution but rather presumptive finding of cummingtonite in Wisconsin. And when one, I think, makes the move from that to an adverse effect on health or welfare, I think there are perhaps some substantial bridges that would have to be crossed.

MR. STEIN: I would agree with you, Mr. Fride. And I am not making the jump necessarily. The conferees have to determine that as to affect the health and welfare.

But I think Dr. Mount, in his present testimony, got rid of that notion in a sense or reconfirmed this on this "presumptive." He believes and he stated that tailings or the effect of tailings got over to Wisconsin waters. That is what he said yesterday.

MR. FRIDE: I don't think there is any question but that there may be a small amount of tailings in Wisconsin waters. I think that is certainly possible.

MR. STEIN: All right.

MR. FRIDE: I think it is really, though, that isn't to say that there is any adverse effect on health or welfare; that isn't to say that there is any adverse effect on fish or any particular beneficial use of Lake Superior. It is true that a very minute fraction of tailings may on occasion be carried--obviously the rate of suspension is dependent upon the size of the particle, and I don't think that I could reasonably suggest that some of those particles may not on occasion get into Wisconsin waters. As a matter of fact, Reserve has reported to the Minnesota Agency, as well as the Federal agency, that it has found cummingtonite in Wisconsin waters.

MR. STEIN: I think we are very close together, and I have great respect for your probity, Mr. Fride, and your analysis of the evidence. I think, though, in addition to what Dr. Mount indicated was the effect of these tailings in Wisconsin waters--and you listed the possible effects on fish, endangering health or welfare, bottom-organisms biota--he also indicated that in his opinion this was affecting the clarity of those waters.

Now, again, you can make a judgment whether this is a significant effect, whether this constitutes endangering the health or welfare, but I think in fairness to the substance of the testimony that Dr. Mount gave this was the essence of his statement yesterday.

MR. FRIDE: Well, I certainly have great respect for Dr. Mount. I think that, however, like any person reporting on opinions and conclusions, that there might have been differences of opinion; but I think more often--and I think as Mr. Haley will mention, and we don't want to prolong this--but I think one of the important things to look at when one is considering an opinion or a conclusion is what kind of data was the premise upon which that conclusion was arrived at. We have been really, I think, in a way subject to a lot of different jumps. I know that the Chairman hasn't made the jump. You just indicated that, and I am sure that with the analysis that you bring to bear on this subject that you wouldn't. But there is a statement of green water and there is--I am just pointing out that one shouldn't jump from that to the question of whether it is caused by tailings. And again with respect to the statements which Dr. Mount made yesterday, I think again that they have to be examined, certainly not with any question of Dr. Mount's ability or his integrity at all, but they do have to be looked at from the point of view of what was the data; what was the premise upon which these things were found.

And if I might just suggest one little example here, the Chairman has indicated that Dr. Mount found green water over a substantial area of the lake, and I think that when one looks at the data that was the basis for that conclusion, really it related to a very few observations during a very short period of time in 1968 which data was previously submitted to this conference and has simply been recast in terms of arriving at different conclusions on the exact same data. And I think that is the kind of thing that I am sure the conferees will want to give consideration to in their deliberations.

MR. STEIN: Thank you.

Are there any other comments or questions?

If not, Mr. Fride, would you proceed.

MR. FRIDE: Thank you very much, Mr. Chairman. Mr. Haley, please.

KENNETH HALEY

MANAGER OF RESEARCH AND DEVELOPMENT DIVISION
VICE PRESIDENT, RESERVE MINING COMPANY
DULUTH, MINNESOTA

MR. HALEY: My name is Kenneth Haley, Vice President of Reserve Mining Company, Manager of Research and Development. I was Chairman of the Task Force Committee to prepare the engineering reports on the alternate methods.

I had a few comments I was going to make on the six reports that were submitted yesterday by the National Water Quality Lab. Perhaps in the questioning here a lot of that has already been covered, but I will go through it very briefly.

The first comment I would like to make is on the report No. 1, which is the physical characteristics of green water along the north shore of Lake Superior.

This information was originally published December 1968 by FWPCA under the title "Special Report on Water Quality of Lake Superior in the Vicinity of Silver Bay, Minnesota." This report only contains a result of 30 samples and observations secured during only 11 days. This is far too little data upon which to premise reliable conclusions on such a complex subject.

Certainly during storms and shallow thermocline conditions tailings do cause some so-called green water in the vicinity of Reserve's discharge in the harbor. Even during these conditions the color of the water is not measurable by standard methods of measuring water color and the turbidity does not exceed the most rigid State-Federal standards.

Their results only indicate that suspended solids in the water from different areas of the lake are different and not that this difference in suspended solids is a basic cause of green water. Their clear water samples were obtained from three miles above Reserve's discharge to fifteen miles northeast of the plant. The green water samples were secured from adjacent to Reserve's discharge to 19 miles southwest of the plant. Also the green and blue water samples were not taken on the same days. Their discussion indicates that there were blue and green water very close together in the same general area of the lake that could and should have been sampled. Had they made these comparisons, it is our belief that they would have found very little difference in the analysis of the suspended solids in the blue and the green water.

Inasmuch as it is now acknowledged that cummingtonite enters Lake Superior via numerous streams, the mere qualitative showing of cummingtonite's presence alone among solids found in green water does not mean that that mineral originated from Reserve's discharge.

Report No. 2, distribution of taconite tailings in the sediments of the western basin of Lake Superior.

Some of the data in this report confirms

Reserve's earlier presentation that cummingtonite is indeed found in numerous Minnesota and Wisconsin streams. Further it shows that variations in the concentration of cummingtonite on the lake bottom are not necessarily due to Reserve's discharge, since similar variations are found well beneath the top layers of some of their bottom cores.

The FWPCA secured their north shore stream samples from the north side of Highway 61. Had they secured these samples from the lake side of Highway 61 they would have also picked up the effect of road construction and sanding with tailings and their cummingtonite analysis would have probably been at least one to two percent higher. Assuming only one percent higher cummingtonite analysis due to truck haulage of tailings along the north shore, the average of all streams and the standard deviation would have been higher. Recalculating on this basis only leaves four stations, 20, 40, 42 and 7, which have higher than expected cummingtonite. These stations are outside the area that Reserve has previously reported to be covered with their tailings. There is no apparent reason for these higher cummingtonite in these surface layers of these bottom samples. They are so widely scattered that it is unlikely that the cause could have been taconite tailings.

Report No. 3, effect of taconite on bacteria growth.

Tailings are not a source of bacterial contamination and do not contribute bacteria to the lake. Tailings, like any other suspended solid found in Lake Superior, may provide surface area on which bacteria may attach. It is suggested that normal suspended solids to the lake should be used as a control to compare with tailings on tests of this type. It is possible that natural lake sediments would have shown the same results as taconite tailings.

There has been no demonstrable harm or increase of turbidity evident over the 14 years of Reserve's operation. While it is conceivable bacteria can attach to tailings, the same is true with any other substance or particulate matter and tests do not support the conclusions suggested.

Taconite bioassays, Report 4.

The survival rate of the control organisms was well below the accepted levels. Therefore, no meaningful conclusions can be drawn from this data. Standard Methods of the Examination of Water and Wastewater, 12th Edition, page 554, states:

"There should be no more than 10 percent mortality among controls during the course of any test, and at least 90 percent must remain in apparent good health."

If further studies should establish any support whatsoever for the conclusion that "Direct toxic effects of tailings on lake organisms were found at concentrations that would be expected to occur only in local areas of the lake," the local areas that would have over 200 milligrams per liter suspended solids are extremely small just off the tailings discharge, probably less than 1,000 square yards in total.

Report No. 5, effect of taconite tailings on algae growth.

Every value of this test is within their announced experimental error of their control. Therefore, no conclusion can be drawn from this data.

Tailings were heated to 140 degrees Fahrenheit, 60 degrees Centigrade for pasteurization. This is sufficient temperature to cause some silica to go in solution which would have not gone into solution at temperatures encountered in Lake Superior.

Further, even the control had an algal bloom (greater than 500 cells per milliliter) before the test started and Lake Superior does not have that population of algae.

The report suggests that nutrients, silicon, magnesium, sodium, potassium, and manganese, could contribute to the eutrophic effect. This is only true if these elements are limiting to algal growth in Lake Superior. There is no evidence given that they or any one of them is limiting in Lake Superior. Evidence of silicon in Lake Michigan is not necessarily applicable to Lake Superior. Lake Michigan has a higher phosphorus concentration than Superior; therefore, silicon could very well be limiting in Michigan but less likely to be in Superior.

It is likely that 10 percent tailings will lead to increased growth of algae in the laboratory, but in the lake this concentration, if it existed near the surface over a significant area, would reduce light penetration and thereby inhibit algal growth. In fact, this argument was used in an earlier FWPCA report. Actually 1 percent or less tailings are the important consideration in these, and in these amounts no significant increases in algal growth are demonstrated. At 0.1 percent tailings concentration, growth rate of algae is equal to or less than in the controls.

There is, therefore, no evidence that tailings in the concentrations found in the photic zones of Lake Superior have any effect whatsoever on algal growth.

Report No. 6, the dissolution of taconite tailings in Lake Superior.

Reserve Mining Company has followed the chemistry of Lake Superior water in their plant while they were using it and after it is discharged into the lake for a number of years. These results do not show the solubility of tailings that Dr. Glass secured from laboratory results when he endeavored to simulate lake conditions by utilizing in his test ultra-high purity water.

Reserve's results show that no increase in calcium in the plant less than 1 milligram per liter increase through the plant in magnesium, sodium, potassium and slightly over 1 milligram per liter increase in silica.

Permanent water station chemistry studies over a 2-year period, 1968-1969, show no increase in these elements after the tailings are discharged into the lake.

The report describes the conduct of three series of tests, one at 68° F for 90 days and two at 43° F, one for 28 days and one for 322 to 337 days. The tests at 68° F for 90 days represent unrealistic conditions when contrasted with the actual lake temperatures.

Dr. Glass notes in his report:

"The net rates of dissolution, Table 1, increase with decreasing concentration of tailings and dissolved solids. This is probably due to increased clumping of particles in the higher concentrations resulting in less exposed surface area/gram of tailings."

This further indicates that tailings deposited on the bottom of Lake Superior constitute no solubility concern. In fact, they will cover the greater concentrations of more highly soluble natural sediments containing trace metals, thereby retarding the introduction of soluble material into Lake Superior.

It is suggested that if the author of the report had chosen to run the same test with natural sediments, he would have found higher rates of release than he did with tailings.

The next part of our presentation I will be using the slide projector--

MR. STEIN: Before we do that, do we have comments? And then we will talk about your program.

Mr. Haley?

MR. HALEY: Yes, sir.

MR. STEIN: Before we do that, do we have any comments or questions on this part?

You know, I have really one here. Maybe a week or so ago in the New Yorker they had a cartoon of two old codgers looking out of one of these stuffy clubs and one fellow said to the other, "You know," he said, "hemlines are going down," and he said, "I am afraid they will never raise again in our time." (Laughter.)

As we lived our lives, I thought I would never, never in our time see anyone top Churchill, but I guess Reserve has done it. Talking about the RAF he said, "Never have so many owed so much to so few." And you people are putting 60,000 long tons a day of taconite tailings in the lake and what you say is, "Never has the discharge of so much done so little." (Applause and laughter.)

MR. HALEY: I would say that was a well-controlled discharge.

MR. STEIN: Well-- (Laughter.)

Would you go on? All right, why don't you continue with your presentation?

(The following commentary accompanied the showing of slides:)

MR. HALEY: This cell* was made up to give you some concept of the elevations and distances that are involved in our particular problem of having a mine at Babbitt and a concentrating plant at Silver Bay where the water was available. The top elevation here is 1,800 feet above sea level and Lake Superior is 600 feet above sea level and the Lax Lake area, the little hump here at this point (indicating), is in most cases about 1,400 feet above sea level, so to get our material from the Silver Bay plant into this area we need to go over this hump some elevation of 800 feet from the plant and a distance of 5 to 7 miles.

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* All referred to above is a transparency for use with an overhead projector.

The way we have got these made up, these are exact pages from the book and some of them I will just flash on here and have practically no comments on so everybody seeing it can have an idea what the book contains.

This is just a table of contents giving you 19 various proposals.

In our introduction we state that we have made these studies to relieve the concern of some people about our use of Lake Superior, and we have shown that we have obtained five engineering concerns who we believe are among the top people in this particular type of engineering available to us in the world, and these people and our engineers have endeavored to come up with acceptable alternatives to our present means of tailings disposal, and these are covered all in the following pages.

Also we point out here some of the things that are common to many of the proposals--one that any of the proposals that involve lifting or clarification of water, we will have to use flocculants to get this to be taking place in clarifiers or thickeners. We have endeavored to hold our use of flocculants to the same general type that are used in municipal water treatment plants.

Also one of the means of controlling the bottom size of the tailings to get it to be a larger piece and to improve our concentrating process would be to use flotation with amines.

These are the areas that Bechtel Corporation did look at for potential tailings disposal. Of all of these that they looked at to have probable places of putting tailings, there were four chosen as the most likely to be usable and would hold the right amount of tailings, and we could get the tailings there and use it.

This proposal 1-- I might say that these proposals are made somewhat in order of the engineering firms that worked on them and in order of the concept and the knowledge that you people may have of these various proposals. This proposal was presented to the May 13 conference by Trygve Hoff & Associates. Mr. Forssmark did make a few remarks about it and a preliminary indication would be that we would, the same as it is here, that we would take all the tailings from the plant and grind the tailings to -10 mesh size, thicken these tailings and pump them over the hill to the Lax Lake area, where they would then be impounded in a large impoundment area.

We have restudied this particular proposal and the initial proposal that Trygve Hoff came up with. We at that time assumed that we would have to be building powerplants for producing the power required for all the equipment that would be operated here. Since that time we have been in discussion with the Minnesota Power & Light and we have a reasonable belief that we could get that power from the power company, so that has been reduced out of the proposal.

Also all the expenditures that would not be needed to be taken within the first two years of operation have been reduced out of the proposal, so that the proposal instead of being $250-some million as it was at that time in May, it is now $195 million as the capital expenditure.

Each of these capital expenditures, we will note, there are some certain things that are not included, and this is true of most any preliminary engineering study. You only get all the expenditures you are going to be encountered with when you get a detailed engineering study, and these are far from detailed. However, the relationship among the various proposals on these items, even though they are not quite the same, is relative and so two proposals can be compared very easily.

In estimating the annual expenditure for this particular proposal, we have direct operating costs of $12 million, depreciation of over $6 million, interest of $8,700,000, for a total expenditure of $27,284,000.

The proposal itself, placing a dam in the Lax Lake area, would take up some very good hunting and fishing area, recreation area. Lax Lake itself would cease to exist. Dust would be blown from the region because of this particular tailings pond.

One of the biggest problems with the Lax Lake area is that it is such a large drainage area, does drain some 70 square miles. If you remember the slope, the drainage area goes clear back up to elevation 1,800 and there is so much water flowing through this valley that it is far more water than we can use in our process on reclaimed water.

So you have to do something with this water, divert it or let it flow out of your tailings pond into the rivers, et cetera, et cetera. In this case, there was quite a sizable diversion channel built, which diverted about 60 percent of the water away from the tailings pond, but there still would have to be some water diverted into the Beaver River to make this particular proposal work. Also this high dam and this type of a steep valley could be a hazard to the people living in the lower valley.

In each proposal, in order to give you some idea as to the various types of equipment and the amounts of equipment, we thought this type of a line diagram flow sheet giving the numbers of various pieces of equipment and something about their size would give the best concept of this. In this case we are starting out with the existing two launders and going down the various pieces of equipment into the large drainage area that would be required to thicken these fine tailings.

The second proposal, also by Trygve Hoff. Many people have suggested why don't we just take our tailings and haul them back to the mine, put them back in the mine where they came from. Actually, we couldn't operate a mine very well that way because we have to uncover the ore we are mining. However, we did want to come close to that by taking all the tailings and classifying out the coarse tailings to a solid fraction and thickening and filtering the fraction that was too fine to classify out into also thickened tailings which then only had about 20 percent moisture and handle it as a solid material. Then this material, we estimated equipment would be required to transport this material to just south of our Babbitt pit, where it could be dumped on the ground and not interfere with mining operation, but scattered out over the swampy ground and disposed of in that manner. This involved quite a bit of equipment, which you will see on the slide.

The total capital cost of this one was $74 million and the operating expense came up to about $12.5 million per year.

To keep the cars moving in the wintertime, Trygve Hoff did design a sizable thaw shed. In examining it and the times to thaw out these cars, from some of our experience of thawing frozen cars when they do freeze, we realized the thaw shed was quite inadequate and we would have to look at either very extensive thaw sheds or go to electrically-heated railroad cars that would be insulated. This car has not been developed as yet. We would have quite a pilot program to be able to develop it to get such a car to be functional.

So, therefore, without further engineering, without engineering the additional thaw shed or the electrically-heated railroad cars, we decided that it would be completely unusable at this time and did no more engineering.

This is the equipment that was being considered for this. Just for an example, the size, these Agidisc filters here have 2-3/4 times as much filter area as we use to filter all of our concentrate. Here, again, we start out with the existing launders and flow through the various pieces of equipment until we separated the water from the solids, other tailings, and transported the solids to the Babbitt area. And the water in this case from the thickeners would be recycled back to the plant for reuse as process water.

This is a proposal also by Trygve Hoff where they endeavored to find ways and means of pumping the minimum amount of tailings back over the hill and make a reduction in the extreme fine tailings that would be discharging to the lake. In this particular case they designed to make a separation at plus and minus 500 mesh. The reason 500 mesh was chosen, it's 25 micron. Our work on Lake Superior indicates that we have never found any material that has been coarser than 10 micron temporarily suspended in the surface waters from our tailings, so, therefore, if we could make this hydraulic type separation to 25 micron we would essentially have 100 percent of the -10 micron removed from the tailings. In this particular case they designed the various hydroseparators, thickeners, filters and clarifiers to do this work and the balance of the tailings, then, the +500 mesh material, would be flowing across the delta very much like our existing tailings discharge and form a beach and flow off the end of the beach just like it does now.

This did involve quite a bit of equipment and the total expenditures came up for capital expenditures to almost $63 million and the annual expenditures would be over $10 million.

Nobody had ever made this type of separation of this type of material before, so we operated our pilot plant for two months through January and February this year to gather the basic engineering data to determine how to make this separation. Their thickeners and clarifiers are based on purely theoretical data. Our pilot plant data did show that their thickeners were slightly oversized and their clarifiers were undersized, so there would be, really, no change in the overall capital expenditure; it would have to be re-engineered to function properly.

Again this would give us a tailings pond in the Lax Lake area, which I think I have mentioned a few of the problems that you can expect to run into at that particular case.

These are the pieces of equipment that would be involved to do this particular job. We would use the existing tailings launder to start the operation, flow from them into the pieces of equipment. And you note where pieces of equipment are getting into sizable pieces of equipment, 300, 350 diameter clarifiers and 300-foot diameter clarifiers, et cetera, and quite sizable pumps, et cetera, et cetera.

In this proposal Trygve Hoff came up with the thought of doing exactly the same thing and using exactly the same equipment in the previous proposal--making the same separation at plus or minus 500 mesh. And in this case instead of pumping the material up over the hill to the Lax Lake area, we would pump the material down to two 18-inch pipelines into waters 150 feet deep or deeper, and the material pumped through these pipelines would be thickened so it would settle, it would then be pumped through the pipeline at minimum velocity and would settle very reasonably close into that pipeline and would not--and would be below any surface affecting thermocline, and there would be very little likelihood that any of this fine material would find its way up into the surface waters of the lake.

The partial capital cost of this particular one was $14,854,000 and the annual expenditure would be $5,513,000.

This proposal would get the fine fraction of the tailings below any surface affecting thermocline and would answer much of the criticism that has been thrown at Reserve for their tailings discharge, but it would not handle all the criticism that we have had.

This is the various pieces of equipment that would be involved here, actually using the same size thickeners and clarifiers as the previous proposal.

Proposal No. 5 here, I will put the illustration on first, I think I can do it a little easier this way. This is a different approach than some of the others. We have the two existing tailings launders, each of them making a separate tailings beach. Our plan here or the way this plan was worked out would be that we would use diversion dikes, as so, during eight months of the year, say mid-October to mid-June, and we would divert the tailings to these points, as so, and then after the tailings were built up to essentially water level there we would maintain the tailings at these pointed shaped beaches by either driving pilings in them or putting heavy rock on them to hold them there, and in that manner we would end up with a concaved tailings beach instead of a convex beach as it is now.

Then during the months when we have surface affecting thermoclines, mid-June to mid-October, we would remove these diversion dikes, use bulldozers to push them aside or actually maybe need to build the diversion dikes over at the corners and cause the flow to come straight down the middle of the delta, and thereby we would have a curtain stretched across the whole tailings beach here and this curtain would be from 15 feet below the surface of the water to 100 feet below the surface of the water and all the tailings would then be forced to flow underneath this particular curtain and would not get intermixed with any surface affecting thermocline.

We tried this in a little test tank in the lab. We have a 25-foot long 2-foot high 2-foot wide test tank and it did appear to work very well. Actually it didn't work until we pushed the curtain to below the water surface and then it did function very well. And we believe that this could be a way of handling the problem, although--and this is the written statement of just what I have told you--although we would be placing our entire bets on quite an untried scheme, such a curtain that would be exposed to the elements of Lake Superior and without major piloting to be sure that this type of a curtain would stand up under the wave action and the subwave action currents. We would hate to risk our entire operation on such an untried scheme.

The total capital cost here is $3,854,000 and only $2,212,000.

I didn't mention this earlier, but the depreciation--correction--the interest is based in all of these on a 20-year bond except this one, and due to the fact that this is a lesser cost unit, less than $4 million, it is based on a 10-year bond.

This merely says what I told you, that we are concerned about the curtain standing up for the weather. Otherwise we might like to bet on it.

This is the start of six proposals all prepared by Bechtel Corporation and they are all somewhat similar. I will spend more time on the first one and then go through the other five a little more rapidly and not repeat the same things that occur in all six of them.

They are basically designed around making a separation at plus and minus 35 mesh and this is done by using a spiral classifier to classify the cobber magnetic separator tailings only, and this would separate out approximately 50 percent of our tailings as a plus 35 mesh solid material that would be 18 percent moisture. The minus 35 mesh material then would overflow the end of the classifier as a slurry, as a dilute slurry, and join with the rest of the fine slurry tailing through the process and go down the existing tailings launder through large hydroseparators and thickeners on the delta and be thickened and pumped as a thickened slurry to the Lax Lake area where it would be impounded.

The plus 35 mesh material would be used to build dams in the Lax Lake area back of which the fine materials would be impounded. The plus 35 mesh material not required for this dam building would be deposited on land in one of several methods. The methods of handling this plus 35 mesh material is the major difference between these six various proposals.

In this particular one, this proposal 6, they are handling the plus 35 mesh product in railroad cars to a point 5-1/2 miles up our railroad. There they would dump this into hoppers and it would be a start of a conveyor system at that point where it would be conveyed to the Lax Lake area across land and where they would be used to build dams or to pile down. To haul this material all year round we would have to use electrically heated insulated railroad cars to keep these cars from freezing in the wintertime.

This particular proposal has an estimated capital expenditure of $44 million and a total annual expenditure of $7,800,000.

The technicalities of the proposal, to be sure these electrically heated railroad cars would operate we would have to have an extensive pilot program of at least a year, possibly several years, duration to verify that we could maintain such a car in operation. Otherwise you wouldn't risk staking your whole operation on it. And again we would have the various objections that we have raised before on others of having a tailings pond in the Lax Lake area.

This gives the various pieces of equipment that would be required to do this particular proposal, starting out with the existing cobber magnetic separators and going into the various slurry pumps and classifiers, and so forth, of all the pieces of equipment that would be involved to do this particular job.

Proposal No. 7 does exactly the same separation, same techniques, and so forth. To get away from the electrically heated railroad car, bottom dump cars, they have piled the moist tailings of 18 percent moisture down on our delta area in the wintertime and then in the summertime we would reclaim these tailings from this large pile on the delta and haul these tailings, all of the coarse tailings, during the summer months into the Lax Lake area. This, of course, would require additional equipment or we are hauling them continuously. It does get around the electrically heated railroad cars, however.

This particular capital cost here is $49,400,000 and the annual expenditure is $8,571,000.

Our experience of handling pellets in stockpiles on Silver Bay is only 3-1/2 percent moisture. We do have freezing problems with it, with these pellets, on a number of occasions, they are not too serious, but from these problems we can feel assured that we would have considerable freezing problems at 18 percent moisture and the temperatures we have in the Silver Bay area. So I think the first winter we did this we would build a north shore tailings glacier and it would be there as a tourist oddity from there on. Until we could be sure that this would not occur, we would not like to move in this direction.

This is the line diagram of the various pieces of equipment that would be involved in this particular proposal.

Proposal 8, also the same category, making the plus and minus 35 mesh separation. Here they are conveying the tailings, the solids tailings,with overland conveyors in conveyor galleries that are insulated and heated for wintertime operation to the Lax Lake area. There the coarse tailings are again used for dam building, et cetera, and the excess stacked down on the ground and the fine tailings are impounded back of these dams.

The total cost here is $48,200,000 and your annual operating cost of $8,228,000.

Such an overland conveyor system in the wintertime would present some problems that we would really have to engineer quite deeply before we would want to commit ourselves to it, and we would have to be sure we could operate it year round. Again we would still have the problems that we discussed on other methods of uses of tailings in the Lax Lake area, other tailings dams there.

And this is the line diagram of the various pieces of equipment at the Lax Lake area.

This particular proposal gets away from the heated conveyor galleries by again piling the tailings down on the delta in the wintertime and using wider conveyors, covered but not insulated or heated conveyor galleries, to haul it all to the Lax Lake area in the summertime.

In this particular instance it has a capital expenditure of $51,200,000 and a total annual expenditure of about $8.5 million.

And we would have the problems again of the taconite ice cube that we think would freeze in the Silver Bay area and we would have quite a bit of problem in reclaiming it.

And again this is the equipment that would be required to do this particular proposal.

This is another Bechtel Corporation proposal. In this particular case they are hauling the coarse tailings in regular gondolas, again insulated and electrically heated, to an area 32 miles from Silver Bay up our railroad. The reason this particular area was selected is because they could install a car dumper there and the land in that particular spot is such that they could start immediate on-land disposal of tailings by conventional conveyor stacking equipment and stacking the tailings down into 50-foot thick layers.

This particular one has a capital expenditure of $46,200,000 and the annual operating expense would be $8,888,000.

We would have the same problem here as the other proposals that considered the use of electrically heated railroad cars. We would have to pilot them to be sure we would operate them year round and we would have the problems with the tailings disposal area in the Lax Lake area.

This is the various pieces of equipment required to do this particular proposal in the line diagram form.

Here the Bechtel Corporation got around using electrically heated railroad cars, still piling the tailings down at mile 32 up our railroad. It does take considerably more equipment to do it in this manner and again we have our tailings deposited on the delta in the wintertime. They would, I am sure, freeze pretty solid at that point and we would have quite a bit of trouble reclaiming it.

This comes up to a capital expenditure of $54,300,000 and an annual expenditure of $9,713,000.

And here we would have the same potential objections, we would have to pile up this type of an 18 percent moisture stockpile before we could go into it and we would have to really look at the problems in the Lax Lake area with a tailings pond.

And this is the equipment that is required to do this particular proposal.

This is another approach to the problem by Engineering-Science, Inc. They had proposed that they

K. Haley

would make a thickening separation of our tailings into plus and minus 500 mesh material. The plus 500 mesh material would be deposited through launders and across a delta, onto a tailings delta very much like the tailings delta we now have.

The minus 500 mesh material would be all pumped, the overflow from the thickener would all be pumped some 300,000 gallons of water per minute through large pipe deep into the lake, and here it would be diffused over quite a sizable area in a 300-foot depth or deeper. This would diffuse the fine tailings over such an area that the turbidities would be quite low and it could be possible that this diffusion in the deep water would take care of the tailings disposal.

Due to the fact there is some complaint about our tailings being found transported all over the lake bottom, we are somewhat reluctant to consider diffusing it further than it is now, so we are not doing any more engineering on this particular proposal at this time.

This is the first of three proposals that were designed by Parsons-Jurden Corporation. These people have had wide experience in designing tailings disposal systems. They designed the one used at Erie Mining Company and other ones on the range as well as many of them in the southwest.

They come up with three potential alternatives to our present method of disposing of tailings.

The first one is to build a high dike system of tailings disposal right adjacent to the plant site and possibly I can--well, here they would make a separation at plus and minus 150 mesh while using hydroseparators and thickeners. The 150 mesh is somewhat of a natural separation for this combination of equipment and the hydroseparator underflow would be plus 150 mesh. The thickener underflow would be minus 150 mesh and--pardon me--the thickener underflow would be minus 150 mesh and the thickener overflow would be returned to the plant for use as reclaimed water.

To describe this I can use the cell here much better than the written copy.

What we would do would be to take our existing tailings delta area and bulldoze and dragline up in embankments about 30 feet high around the periphery of this present tailings area. We would have our hydroseparators and thickeners here (indicating) and the material underflow from the thickeners, which would be the minus 150 mesh, would be pumped to classifying clones around the periphery of this particular impoundment area, now, because we have embanked it up 30 foot high with tailings. And the coarse product would be discharged immediately out of the bottom of the clone. It would be some 80 to 85 percent solids, so it would settle very close to where it was discharged. The fine material would be discharged further into the center of the pile by hoses and it would contain most of the water and the finer fractions. And so the fine with the water would flow into the center.

There would be detaining towers spaced in this particular area that would be connected back to our harbor intake area, which would decant the water off of the particular solubility tailings pond. The plus 150 mesh out of the hydroseparators would be deposited along the edge of the dike that is being built here with this classifying clones to make a beach, which would protect these dikes from wave action, so you would have a spending beach, so to speak, in front of this particular dike.

Now, the coarse material that is not needed for this spending beach would be gradually used to build a starter dike along about 100 feet deep contour in this direction, as so, and reach this point, and it would come in to land and then there would be dikes built out of clay, rock, et cetera, on land to make an impoundment area No. 2 here. Again there would be decant towers and this impoundment area would drain into our harbor intake.

Again you would use your minus 150 mesh material to use clone classification around the periphery of these dikes that you would start building, and they would cause these to be raised because the coarser fraction would be settled immediately to the edge of the dike impoundment area. The fine material would be as a liquid to the center and the coarse material, the plus 150 mesh material, would be used to make a spending beach in front of all this now diked.

With the coarse material not needed to maintain this spending beach we would build other starting dikes, which would go up in this direction (indicating) and come back to land, and then on land you would build more impoundment dikes until you would impound your third diked area and repeat the process until you would have three impoundment areas of some 600 acres on which you would be pumping your tailings and impounding them reasonably close to land.

And you can see that this whole impoundment area would be some 1,200 feet or so long, and we have a cross section to show this at our Chart 9 here, 900 feet. And a cross section of that east 900--or 9,000, pardon me, gives an idea how this would be in elevation after it was built.

This is the starter dike I was talking to you about that was the first built for the coarse tailings and these are the embankments that would be built with the classified minus 150 mesh tailings. As these got 30 feet high you would step them back then and keep drawing in your whole impoundment area.

This is the spending beach I was referring to that you would have in front of the particular diked area to protect it from wave action.

This is the written description of this particular way of doing it, and in doing this particular piece of work we would have to move both our water treatment plant at Silver Bay and our sewage disposal plant, and taking the capital cost of these two items into account we would end up with a capital expenditure of over $31 million and an annual expenditure of about $5.5 million.

This is the equivalent that would be required to do this particular proposal, starting out with our existing launders and go down through the various steps to carry on this particular function.

The problem that we expect to run into here would be to get these dikes to harden sufficiently so that they would be stable. You have to let them dry out in between times of depositing tailings on them. So, therefore, there would be a minimum of half of the tailings that would be so impounded, it would be dry all the time and would be subject to being borne by wind, and so forth, and there would be some 12,000 foot long beach exposed to the lake.

Another proposal that was engineered by Parsons-Jurden. Here they are using the same hydro-separating thickening equipment to make a separation of plus and minus 150 mesh. The plus 150 mesh they would be piping through some 14 pipes to the edge of our existing delta and there it would be scattered across the face of the delta. This thickened slurry would be discharged just on the edge of the delta, and due to the fact it would be thickened to some 40 to 50 percent solids and it would have no fine material in it, it would settle very much more rapidly than our tailings now do, a higher percentage of the tailings would remain as a beach and the tailings beach would build up faster.

The minus 150 mesh material in this particular case would be pumped to a depth of 150 feet through pipes that would be buoyancy controlled to float at about 140 feet so that when some of the particles of minus 150 mesh material did settle and build up in front of these pipes that the pipes could be raised and you could extend them and start to deposit in another spot. So about every eight or nine months or so you would have to extend these pipes.

This would cause some 27 percent less fine tailings being entered into the lake, if you consider this a reduction of tailings entering the lake by more tailings being retained on the tailings beach. It has the advantage, too, that we would not have a big flow across our tailings delta so that we could landscape our tailings delta and plant it in grass and trees, et cetera, and we could control the shape of the tailings delta by making it convex instead of concave and reduce the amount of wave washing on the face of the delta. This particular project or proposal comes up to $11,620,000 capital expenditure and the annual operating cost is $2,228,000.

And these are the pieces of equipment that are involved in this particular proposal.

The third proposal also of Parsons-Jurden uses the same hydroseparating equipment to thicken the tailings. However, all the thickened tailings are joined together and pumped through a series of pipes into the deep part of the lake, deeper than 150 feet, and the pipes would be buoyancy controlled so that the pipes would float at 140 feet. And when the tailings did build up in front of the pipe to approximately 150 feet, then you would stop discharging tailings through that particular pipe, and you would pump water through that pipe and force compressed air into that water, so that you would cause the pipe to raise to the top of the surface of the lake and pick up the pipe with the work boat and extend it and again pump tailings to it, which would cause it to sink down to a 140 foot depth.

There are several reasons for taking this particular approach. First in your--I don't know which is first or second, but the depths--our tailings delta is now in 400 feet of water, and 400 feet of water deeper is very sparse in bottom fauna. If we use our tailings to build this depth up to 100 to 150 feet we would increase materially the amount of bottom fauna that would be raised in the Silver Bay area without increasing the nutrient content of the water, and that way we would improve the food for the various sport fish of the area.

Also at 150 feet the tailings would be discharged below any surface expecting thermocline, so, therefore, you would not have any tailings in the surface waters.

In this particular proposal they did include money to completely close off the delta itself with pilings, so that there would not be any wave washing of the existing delta, so there would be very little, if any, probability of any of the tailings being found in the surface waters from this particular type of an operation.

This has the expenditure of capital of $12,700,000 and the annual operating expense of $2,224,000.

And these are the pieces of equipment that are required to do this particular proposal.

The small boat harbor won't get rid of very many tailings, but it is another beneficial use of tailings that we could put them to, particularly in the Silver Bay area. There is an area just west of our west breakwater area right here, this is our west breakwater, that we could fill with tailings up to about a depth of 15 feet. This bay is now 40 feet and deeper, so if it were a shallow bay of 15 feet or shallower so that you didn't then have much rock to use to build your breakwater, your 15-foot depth would come out beyond the breakwater, you would take rock right off of this point and build your breakwater here, you could build you a very nice shallow marina and boat harbor and recreational area in this nice harbor. We could use this area right here, slopes down to the shore very gently, and it could be used as a boat launching area, and putting tailings on it could make a sandy beach. Due to the fact that this would be shallow water here and practically enclosed by breakwater, we believe it would warm up in the summertime, so it would be one of the few or maybe the only place along the north shore where you would have swimming in a recreational area.

There is interest in this particular type of thing, not only from Reserve but other people, and there are newspaper articles about this general type of thing, and this is just a copy of one of the newspaper articles about it. It was in the local paper here in February.

We haven't made any capital expenditure of the small boat harbor because we would almost have to know what other type of equipment we were going to use, which would have a lot to do with how much it would cost to get those tailings into this small boat harbor.

This particular proposal is one which would reduce the tailings being discharged to the lake, which is one of the things that we are asked to investigate. And we would be dry cobbing of rod mill feed. We would take our material before we start the wet grinding or wet magnetic separation and at the plus 3/4-inch--at the size of just barely minus 3/4-inch, I should say, we would make a magnetic separation in the dry state, and this we can separate out some 30 percent. We have known for sometime that this was potentially possible in the laboratory, and we had been hunting for pieces of equipment that may do this type of a job. There were real early studies as to dry cobbing tailings in this very similar manner, but the type of cobbing magnetic separators we used in those days were quite different from the ones that are on the market today. Where those mag. separators only had a Gauss strength of three, four, five hundred Gauss, the one that we are using here has a Gauss strength of 1600 Gauss at the surface and 800 at two inches from face of the drum, which is quite a different piece of equipment. And this piece of equipment was being elevated by the mine's experiment station. It was built as a trial model by Dings Magnetic Separator Company, and we have secured it for this test work. We have conducted some pilot plant work on it, and it looks like it is going to be successful. It is going to take some more pilot plant work. This does change the entire concept of our mineral beneficiation, and we have to rebalance our circuit to fit this into it and make the old lot of equipment now operatable together. And this is one of the reasons that we are saying we need 16 more days or so before this is going to be complete. We are sure this is going to be complete, the preliminary engineering bit, though, before our July 26 date.

Another method of changing our method of operation and to endeavor to improve our tailings processing, here we are going to--and we have in pilot plant testing--screen our material before it enters the rod mill, and in this case, we would only put into the rod mill the material that is plus, say, 10 mesh. We are testing various sized fractions and seeing what is practical to do here.

This appears from our pilot plant work that we are going to be able to work it out. We again have pilot plant work to do to know exactly what circuit we are going to come up with, but it looks good enough that we are going to be able to come up with something.

There are several advantages of this. One that you will be doing more grinding in the rod mill, so to speak. A rod mill does not grind as fine as your ball mills do, so you will get greater reduction in a piece of equipment that does not generate the ultrafine, so to speak. So we hope to end up here, and I am reasonably sure we will, with lesser, say, minus 10 micron pieces in our final tailings than we now have with our present circuitry. How much less this is going to be we will not know until we finish our pilot plant work. And again this would help all the tailings process and would fit in with many of the other particular proposals.

Our last proposal here, proposal 19, is looking at some commercial uses of our tailings. Reserve people from time to time have had various ideas of how we might use our tailings commercially, and they have been investigated, and other people have suggested to us various means of using our tailings, and we have been investigating them in the past years. This is the first time we have retained, you might say, a market research specialist to really investigate this problem. They are investigating this problem and are examining all the potential markets within the Great Lakes area or within railroad distance of Silver Bay as to potential uses of our tailings. We don't think that they are going to be able to dispose of all of our tailings, but if they can dispose of any of them, particularly if somebody should be interested in the real nice fine tailings, it could help the problem in this manner and we certainly want to give it a good college try. And we believe these people are doing it.

Any questions on these that would require the slides before I make a few concluding remarks?

MR. STEIN: No. Go ahead.

When did you prepare these slides?

MR. HALEY: Pardon me, sir?

MR. STEIN: When was this all prepared, Mr. Haley, this winter?

MR. HALEY: I still didn't hear you.

MR. STEIN: When was this all prepared, this winter?

MR. HALEY: We started to preparing this particular report about 30 to 40 days ago. As we got any particular one of these particular projects close to a completion stage, we started to prepare these summaries and we did have them completed in the form that you now see them by April 1 and had them available to report to the Minnesota Pollution Control Agency.

MR. STEIN: Now--

MR. HALEY: Was that your question?

MR. STEIN: Yes. I guess that shatters another myth. I was told that in Silver Bay you spent the long winters doing something else, but I see that you didn't. (Laughter.)

MR. HALEY: Well, would you care to spend the winter in Silver Bay and see? (Laughter.)

Reserve believes that a fair and realistic appraisal of all of the data submitted to the conferees in connection with taconite tailings compels the conclusion that they are not having any material or significant effect on the water quality of Lake Superior, nor on any beneficial use of that lake.

Reserve suggests that all parties, especially the public, would be better served if Reserve, the Minnesota Pollution Control Agency, and the Federal Water Quality Administration, would, in the future (a) standardize, to the maximum extent practicable, the equipment, techniques and methodology employed in water quality sampling and analyses, (b) agree to exchange of data and information, and (c) freely discuss the data in an attempt to arrive at scientifically acceptable findings and evaluations.

Reserve has pledged to explore possible alterations or modifications in its discharge and has provided the conferees with the working copy of the progress made to date by eminently qualified engineers. In good faith, Reserve will carry out its announced policy and report further progress of these studies to the conferees.

MR. STEIN: Thank you.

(See report at pages 666 to 752 and 641 to 642.)

MR. STEIN: Are there any questions of Mr.Haley?

MR. PURDY: No question, Mr. Chairman. Just a comment that probably will not add much to the conference, but I feel compelled to make.

I studied the reports prior to coming to this conference, and I am impressed by the amount of detailed engineering work that has been accomplished in this interim period. I am also impressed by the economic analysis that has been made in the engineering reports.

But I also can't help but consider some of the remarks of some of the earlier speakers. In particular,

K. Haley

I think of young Mr. Nelson, from the Gogebic Community College, and his statement about the boundary lines in the lake should really not be there; this belongs to everybody.

I also think about our quite fine mine in Michigan that at the present time has disposed roughly 30,000 tons of tailings a day upon the land. They have filled some 1,200 acres and have started in on their second tailings basin; they will be expanding until about 40,000 tons of tailings a day; will have a 2,100 acre tailings lagoon.

Certainly these tailings ponds are unsightly upon the landscape, but this is now on property that has been purchased by that mining company and some compensation has been paid out for it.

I am wondering how the economic analysis might compare if, in the economic analysis presented by Reserve, that also there would be some comparison with, say, reasonable compensation for using the lake for the dumping of the tailings. At the present time now this is a free charge.

This doesn't really relate to the problem of whether or not there is interstate pollution, but it seems that to compare the cost of the many schemes presented that there should be some comparison with a reasonable cost of the scheme that is now being used. At the present time, it is not being paid out to the people of Wisconsin, Michigan, Minnesota and Ontario, but the lake belongs to these people.

MR. STEIN: Is there any comment on that? I think that adds quite a bit to the conference.

MR. HALEY: Well, all the cost figures we have given here are costs over and above our existing methods of handling tailings. There is no substitution.

MR. STEIN: No, I don't think you have--maybe you did or you didn't get Mr. Purdy's point. Mr. Purdy is talking about comparing costs that you would have to pay to put this stuff on the land, but then he gives you the notion that you can equate putting the stuff in the lake for free. (Applause.)

MR. HALEY: Well, I to date don't--I haven't understood the question yet, then. But the cost--

MR. STEIN: You see, this is what is bothering a lot of people here. If we did that and we got everyone to understand that question, I think we would get a lot closer together.

VOICES FROM THE AUDIENCE: Hear, hear.

MR. HALEY: Each particular instance of handling ores in mining and mineral beneficiation certainly have their own cost features and on particular systems of handling their various raw materials. Now, had there been water available at Babbitt, Minnesota, et cetera, this Reserve Mining Company plant would have been built at Babbitt, Minnesota, and we would have been doing our process the least costly way. We are not gaining anything over any other mining operation by what we are doing by the fact that we are using the lake,if that is the implication.

MR. STEIN: No, I don't think there is any implication for you. Here, let's try this again, because I think if your company doesn't understand it, and I see these people out in the audience, and maybe this is what is on their minds.

The notion here is that--and I think I am speaking for them in trying to state this--you are not going to dump your junk on your neighbor's land or even on your own land right next to him or on some land somewhere else, but the notion is that you can pick any convenient watercourse or lake in the country and put your stuff in there and that is for free. That is why we have pollution in this country. This is what these people out here just fail to understand.

Mr. Purdy points that out. When you are talking about the cost of putting material on the land and equating that with a free cost of dumping it in the waters of Lake Superior, these people have the notion that maybe the free dump in Lake Superior shouldn't be allowed. (Applause.)

MR. HALEY: Well, I could endeavor to answer that, and the answer isn't as simple as I think a lot of people would like for it to be. I answered it the best way that I knew how--that if there had been the opportunity for Reserve originally to have not hauled all this material to Silver Bay and used Lake Superior, they would not have done it, and without this particular use of the water in the tailings disposal, this particular mine would have never been opened or operated under the conditions with which we are now working. All these problems of whether there would have been pollution or not from this use of the lake were thoroughly investigated before this was started, and the conclusion was arrived at that there would be no pollution by this use of the lake or this use of the environment.

So far we have been operating for some 15 years, and we have filled up a bay of the lake and have raised the lake bottom some minor amount, but, as yet, there has not been any pollution of Lake Superior as such. The water quality has not changed. So we used the environment--

MR. STEIN: Let me put the question to you another way, because I assume you are serious about that. (Laughter.) Do you think, in this day and age, if you came for a permit for your taconite plant in Silver Bay, that you would get that permit? If you would start it up tomorrow, and let's suppose you had this vast experience, but didn't have a plant, do you believe that you wouldn't be polluting the lake? I don't know. You see, if we-- And I know at these conferences there might be a lot of posturing on various people's part.

But the point is, I think you are talking to

State regulatory officials and people out there, and I think that maybe you are taking these attitudes for a legal position, I don't know. But you are the neighbors of these people and you have to live with them. I don't think you are communicating if this is the attitude you are taking. Certainly, the other testimony we have heard operates from a completely different premise.

I think really--and I speak to you all--if we are going to come up with a solution we have to get together. This is the same kind of problem we have all over. We had this widespread when we were dealing with shellfish on Long Island. When these duck farmers were putting this stuff into the bay, we had to get the duck farmers to sit down with the oystermen. It is the same old hurdle we had in the west of getting the sheepmen and the cattlemen to sit down and live together. Now, I think the sooner all the people here get down and start living together and talking about this, the sooner we will have a solution. But when we get the opposite sides of this, you are making our job very, very difficult.

MR. HALEY: Sir, I don't believe you have anybody that has worked more diligently or endeavored to find qualified engineers to endeavor to find an alternate method that would fit this particular problem any harder than Reserve Mining people have. And if you or any of the other people have any suggestions you think we should be following up on that we have not been, we would certainly welcome them.

MR. STEIN: Mr. Haley, let's stay with that because I think--and I have looked at this and read the reports--I think that is the way to the solution. In looking at your reports, I don't doubt in the least that you have got the qualified engineers and are coming up with alternate proposals. In evaluating and sensing what the other testimony is, they want a solution that is to put in remedial action; and no one,as far as I know, is out to close the mill. If we stay on that kind of wave length, we might arrive at an accommodation. If we get into this morass of saying, "By putting in 60,000 long tons of wastes a day for 15 years, we haven't hurt the lake," I think you are going to be at loggerheads with some other people who have presented views here.

I am trying to get both sides to get together in an area of mutual accommodation so we can resolve this case. I think the American system of justice is such that we can do it. But I would suggest the more we stay on the positive operation of remedial action, the closer we are going to be to that goal.

Are there any other comments or questions?

MR. MACKIE: Yes. Mr. Haley.

MR. HALEY: Yes, sir.

MR. MACKIE: This has been interesting getting this preliminary report. Would you care to comment on what the conference can expect in three months, when we convene again, by way of perhaps more complete details with perhaps a more complete timetable?

MR. HALEY: We expect to have all the preliminary engineering done before that time and evaluated in such a manner that we will be in a much better position to pass judgment on what we think is a possible course of action, and I believe that the other people that are involved will have had an opportunity to look these situations over also, and we should be much closer to a potential solution.

MR. MACKIE: Do you anticipate that you will have selected by that time any of these plans for detailed engineering, not just that they are ready for detailed engineering but that the company would be in a position to say that they are going ahead with detailed engineering?

MR. HALEY: I think by that time that we should be in a position to have a number of these that would be very ready for detailed engineering. As to how this judgment is going to be arrived at, I am not too sure myself. I think that is one of the stumbling blocks to the true answer to your question.

MR. STEIN: May I expand on your question just one second?

MR. HALEY: Sure.

MR. STEIN: Let me ask, when we reconvene--I know Mr. Fride knows this, and he has been kind enough to not make this too fine a point--the six months runs out on about July 26. Suppose we reconvene early in August. Will Reserve Mining be in the position at that time to say they have one, two or three plans certain that they are ready to go forward with; outline those plans and a time schedule for those plans; and they will go forward with it if the regulatory agencies agree that those plans are adequate?

MR. HALEY: Was he addressing that to me?

MR. FRIDE: I was feeling kind of left out, so I thought I would come up.

MR. STEIN: Yes, I thought you would be up here. (Laughter.)

MR. FRIDE: I think that what you have seen today and what I think you have seen in the past is evidence of good faith, evidence of a great deal of work, and evidence of the kinds of thinking that will lead, we hope, to a reasonable and practical solution to this problem.

I think, however, you have to keep in mind a couple of things, as I am sure the conferees are well aware of, which are referring also to our audience here, and I am delighted and pleased that we have such a good group here today and yesterday to listen to the evidence and to listen to the testimony and views.

I think that one has to start a little bit with the idea of whether or not there is any harm, and if you pass that, I think then you have to indicate what kind of harm, if any, is being caused, because in order to try to find a solution to a problem, I think you first of all have to know and identify what the problem is in terms of harm or in terms of potential harm. And I think that Dr. Mount and his staff, in many respects, in the presentation made yesterday, importantly contributed to a posture on their part as to what may be an area which they regard with the greatest concern. I think Dr. Mount indicated that the material that was being deposited in the deep trough adjacent to the discharge of Silver Bay, that, for the most part, that was true that there was a possibility that some -2 micron material may not be settling as rapidly there as he would like. If that is the problem, of course, it does attempt to define the kind of an engineering solution that we can look for and that we can try to arrive at.

We do get into a little situation, of course, with the old chicken and the egg situation. We can propose a particular solution and we need, of course, the guidance and the judgment of the regulatory agencies in order to make a meaningful resolution of this particular problem. And I think in that connection that we welcome, as Mr. Haley has indicated, the kinds of concerns that are being expressed here.

But I don't think that I can or Mr. Haley or Mr. Furness, the President of this Company, who is in the audience, can tell you that on July 26 or August 1 that Reserve Mining Company will have an absolute answer to the problem that is posed. I think that you can be sure that we will continue to exercise good hard work in an effort to find it. I think also that we are going to need the kinds of guidance and recommendations from the conferees and from the other regulatory agencies that are being involved in this problem.

I think perhaps if I can just dwell for a moment on the situation in which Reserve Mining Company finds itself, I am sure the conferees appreciate it. It is a situation where, you know, I have lived in the city most of my life. A few years ago Reserve Mining Company when it started its operation was certainly the company with the white hat. It was the company that started to revitalize the northeastern part of Minnesota. I don't think that anybody worked harder than that company to do that, nor did any company ever--and if you will examine the transcript of the records and the files, you will find that actually the wisdom of the regulatory agencies in 1947 and 1950 and 1960, when all of the other hearings were held, has been demonstrated quite, I think, importantly, because none of the problems that have been raised here are unique or different from the kinds of problems that were raised then. The Federal Government, the State of Wisconsin, many, many agencies examined all of the possible potential kinds of harm that might be occasioned if this plant were built, and all of them on the basis of their best judgment, on the basis of all of the evidence, indicated that there was no harm or potential harm.

Now, to try to suggest, for example, if we are in an arena, and I am sure we are not here; but if we are in a situation where, oh--obviously nobody is foolish enough not to be aware of the environmental concern today and in many respects Reserve applauds it.

I think that what we have to do, however, is to look at the particular problem and then try to reach in good faith a solution, and we would welcome the judgment and the guidance of the regulatory agencies--the other people who are involved with this problem. But we have to get a little closer to identifying the problem and to try to find a solution to it.

MR. STEIN: Well, all right. Let me just--and I want to let Mr. Mayo go for a moment.

Mr. Fride, I have looked at this history very carefully too. I am convinced certainly that the engineers who originally designed this plant were not out of their minds when they proposed this waste disposal. The point is, sure, everyone was concerned. But, as I understand it, the company decided--if I am wrong maybe I should be corrected--that after the plant started and the grinding took place, those big particles that the engineers thought would go to the bottom were fine, but it would be more economical and one would get a better payload if one ground the stuff finer. And as it was ground finer, the stuff began to drift out into the lake. So, actually, you are not proceeding with the process as was originally proposed, as it was originally approved (applause) and you changed it, which is all right.

Now, the second point I have is that I don't know if you are going to come up with any different alternatives to these almost 20 you came up with. If you are not designing these proposals to relieve certain damages, what can we expect between now and August?

MR. FRIDE: I think you can expect what Mr. Haley said and that is that the present engineering studies which are not complete will be completed.

But if I can just refer back, Mr. Stein, for just a moment to what you just said.

MR. STEIN: All right.

MR. FRIDE: That is that the situation in the discharge today is different from that which was postulated before the plant was built. I think it is, but I think an important difference should be kept in mind, and that is that if you will look at the screen analysis of the proposed tailings prior to the building of this plant, you will find that they are considerably finer than the material that is being deposited in Lake Superior today. In other words, rather than more potential harm, there is less because of the fact that the tailings analysis now is considerably coarser, hence will settle faster, and hence will further implement the concept that this plant was built upon. (Applause.)

MR. MACKIE: Mr. Chairman.

MR. STEIN: Yes, go ahead.

MR. MACKIE: I may not get the answer that I wanted to the question that I asked before, but maybe we can get a little closer to it. I think probably the conferees--I know we will probably want to do some independent evaluation of some of these proposals. I am wondering if the company can furnish us, within the next week or so, some sort of a statement as to the individual proposals or combinations of proposals that would be most likely to reach the detailed engineering stage, so that we can perhaps not spin our own wheels evaluating proposals that may never get to that point.

MR. FRIDE: Well, I think that, as you will review the reports that have been placed before you, you will see preliminary comments by Mr.Haley and by the eminently qualified engineers that prepared them. I think that there seems to be a trend more in favor of certain combinations, etc.

But I think again that we are a little hard put, as I am sure I would be if I were a conferee. If I were a conferee and I had this data before me and somebody said, "All right, Mr. Conferee, you have got the authority to make the decision. What decision do you choose?" I think that one has to recognize that these are not simple answers that can be postulated on that kind of a premise.

MR. MACKIE: That is precisely the point I was making. We would like not to waste our time on things that aren't going to reach that stage. (Laughter.)

MR. STEIN: I think again that is a fair point. Your presentation indicated here maybe 10 of these proposals "no further work done, abandoned. I believe that might have been a good point which indicates you made a good college try and a good effort. But the point that was made for the consideration of the conferees is: Can we just concentrate on the serious proposals from here on out?

MR. FRIDE: Well, I think a little bit also you ought to go back to the basis upon which this presentation is being made today. You ought to have in mind the kinds of time frame within which we are working. You might have in mind that the original summary called for a progress report in six months. By going outside of the summary, the Secretary determined the advisability of cutting that time to April 1.

Now, I think that, as you have indicated, Mr. Chairman--and we appreciate what you said--there has been a great deal of work done and more will be coming; but we can't tell you today that there is a certain one or a certain combination of these things which will be proposed as any definitive solution. I do think again that we need some consideration and guidance not only from this group but, you know, we are a little bit, and I don't mean to be facetious, but there is just a little bit perhaps of an analogy that might be drawn here with a patient whose doctors say the patient is perfectly well but somehow somebody is insisting on an operation. Now, we don't mind going to another doctor and getting another diagnosis, but we can't tell you right offhand now how much of the surgery we can stand.

MR. STEIN: Well, I know, no company knows how much of the surgery they can stand, and that is the problem I always have.

As I understand it, the fines cause the problem, and I don't doubt your statement that you are putting in more coarse material than you originally planned to put in. I wonder--you didn't answer the question as to whether you are putting in more fine material than you originally planned--

MR. FRIDE: I meant the answer--

MR. STEIN: --and that creates the problem.

MR. FRIDE: I meant the answer to be inclusive of that, Mr. Stein.

MR. STEIN: In other words, you are putting out less fines than was originally intended?

MR. FRIDE: That is correct, by the screening analysis.

MR. STEIN: All right.

MR. FRIDE: And there are records supporting this statement.

I might suggest this for any help it may shed on this problem: I know that the conferees are all very busy people, but I would suggest that it might help in their understanding and their appraisal of the situation for them to come to Silver Bay and to Babbitt to look at the plants, and I extend to you now, as I did in May on behalf of the President, an invitation to come up and look at the situation. I think sometimes things become a little clearer and maybe a little bit helpful to the conferees.

MR. STEIN: Are there any other comments or questions?

Mr. Mayo.

MR. MAYO: I have one question. Mr. Fride, perhaps either you or Mr. Haley could give me a response.

Aside from Proposal No. 1 and perhaps Proposal No. 13, which of the proposals do you feel could meet the criteria that Secretary Hickel recommended to General Clarke in his February 11 letter?

MR. FRIDE: Well, it is always easier, I guess, Mr. Mayo, to ask the questions than to answer them. I guess I know that pretty well in the business that I am in.

But let me just suggest this as far as Secretary Hickel's letter to General Clarke is concerned.

That letter, I am a little concerned, may have been written without an appreciation of what the permits to which he was addressing himself contain. I think by a relatively simple technique of suggesting that a certain paragraph be adopted in a new permit which existed someplace else but which in fact does not exist any place else, he then gives the impression that some way, somehow this should be implemented by the Corps of Engineers.

Now, again, I think it begs the question of whether or not there is any harm. But passing that for the moment, any time you have a discharge to the lake you have to take into consideration the physical characteristics of the lake, and you will note that the permits that we are talking about, from time to time, contain a zone of discharge. It has been variously identified as a 9-square-mile area.

But, I think it must be borne in mind that unlike certain suggestions that have been made, that is not a confining area for tailings. It was identified as the area in which the tailings were placed. It was a geographic dimension where the tailings are going to be discharged. It certainly was never intended to be, and I am sure that if the Secretary had an opportunity to analyze it he would recognize it was never intended to stop the tailings from flowing into the deep trough. After all, that was the premise upon which the plant was built and all the hearings were held, and any more than you could stop a ball from rolling downhill, any kind of an artificial limitation at the bottom of the lake, where the tailings are being carried by the heavy density current to attempt to confine it to an area five miles or three miles or one mile from a particular point when in fact it is going where it is supposed to go, namely into a deep trough which is further out than that, is completely unrealistic.

MR. STEIN: Oh, boy, here we go. (Laughter.)

I didn't write that letter. But I think what bothers Dr. Mount is this notion that these fines run down that deep trough like a ball going downhill, just lie there, and don't go anywhere else, may be open to question. He is worried about their getting down there, then coming up, and then drifting out. And where do you think they might go to--to Wisconsin?

MR. FRIDE: I think that a fair appraisal of the evidence that has been submitted would reflect by some very knowledgeable people that when they are down on the bottom of the deep trough, I haven't seen really any significant kinds of information or evidence that there is any upwelling once the material is down in the deep trough. I think that we are again perhaps jumping subjects. I think that there may have been some concern about whether or not, before the material gets down into the deep trough, there is a certain limited portion of it that is fine enough so that its settling rate is a little bit different or slower than the main body of tailings; and that may be carried some little distance away by lake currents before it settles. And I think that that is probably where that idea originated.

MR. STEIN: We have got a key point here, Mr. Fride. Just bear with me on this, because I think this may be the really essential point of whether we can arrive at a solution of the case in any manner, whether you are going to discharge tailings into that lake or not. And the issue here is this:

It is whether when you put this in you are--

you have some kind of phrase for that current you use going down. What do you call it, "deep current"?

MR. FRIDE: "Heavy density current," Mr. Chairman.

MR. STEIN: "Heavy density current." Boy, that phrase rolls off the tongue.

MR. FRIDE: It wasn't original with Reserve.

MR. STEIN: I know.

MR. FRIDE: It has been a natural phenomenon for many, many years in this country and the world.

MR. STEIN: Yes, if I found that I would use it too. It is great. (Laughter.)

I play Beethoven and I didn't originate that either. But the question is, if we had the heavy density current, and if the material is going down and stays down, we have got one thing and you can come up with a variety of solutions. I have heard this from our people, and we have heard it here, and these are the assumptions of the report--if they say that the material goes down and it doesn't quite stay down, but comes up and gets dispersed in the lake, then we have a problem. I say this not in a contentious way at all, because I think this is possibly going to be the key to whether we can agree on a whole spectrum of solutions or not. Using this "heavy density current" and having the material go down, if this is acceptable as a premise to the technical, scientific people on both sides, we can proceed. But if it is not, I think both the company and the State and Federal agencies should recognize that at the earliest possible stage, so that we can either come up with an alternate solution that our people believe will work, that you believe will work and be reasonable or else recognize that we might have a difference.

As far as I see, this one scientific fact is what the case boils down to in our working out an amicable solution. I think if what you say is correct and this material stays down in this "heavy density current," then you have a variety of solutions which might be acceptable. If it doesn't, then, of course, you almost have to think in terms of possibly a lot more land disposal than you are ready to think of.

MR. FRIDE: I would suggest in that connection that if the conferees will refer back to the testimony that was presented at the May conference by Dr. Robert Ragotzkie, one of the internationally known specialists in lake currents and in this kind of a subject matter, that the answer is there in the conference proceedings to date, and that is, and I think he said it very clearly, that once this material reaches the deep trough at the bottom of the lake it remains there.

MR. STEIN: Dr. Mount, could you come up? Do you agree with that? Could you come up and let's see? Because I think we can save months if we at least get the issue resolved and see what the point is. If you don't get to this we are operating on two different assumptions.

MR. FRIDE: I think that it is only fair to suggest, too, that we came to this conference on the premise of submitting a working copy of the report, and certainly we do not suggest that this line of inquiry is inappropriate. I do suggest that had you indicated or had we known that you expected a dialogue on this particular subject, we would have had people here a little bit more versed to speak to the subject.

MR. STEIN: I am not asking for a dialogue. I am asking for an opinion, because a good many of your proposals are based on that assumption. I have no judgment on that assumption, and I surely don't know enough about it.

Dr. Mount, can you answer that in one way or another? Do you think if they put this stuff down in a "heavy density current" that that will be satisfactory?

DR. MOUNT: There have been some settling studies done by both the Geological Survey and the FWPCA, as it was then called, in which they showed that the fine particles required days to settle. There was also a current study done in which current meters were placed in the lake, and these meters revealed that there are persistent currents in the lake that vary in their velocity, being faster at the top and faster at the bottom.

Now, what I have said so far is that there are currents that move the water around the lake, and that the settling rate of particles are measured in days. If I do my calculations right--and I am not too hot on mathematics--Reserve's discharge in volume is equivalent to something in the order of two acre feet per minute. That is an acre of water 12 inches deep; that is an acre foot;

and there are two of those a minute coming out. In my book that is a big volume of water, and it has got to go somewhere. If it takes several days for the particles to settle and if we put a large volume of water in the trough, it is going to be moved out of the trough by the currents, and it is going to carry with it whatever particles are suspended in that water. (Applause.)

MR. STEIN: Dr. Mount, what I am saying and want to suggest to you and the company and the States before we go ahead with these proposals is that we at least get this settled. I think this is for the benefit of the company too. They are spending a lot of money, effort, and ingenuity on this. The point is if you come up with a plan which you in good faith think is going to work and is going to be acceptable when we come back here, say, in early August, and if Dr. Mount or someone on the Federal staff or scientists on the State staff have a fundamental objection to the whole concept, then I think we should meet that. To my mind, it is best for the company, the States and the Federal Government to meet that issue as early as possible so we know where we are going. Otherwise, we are going to go through this same thing again.

By the way, I don't necessarily ask for colloquy. You should get your men together. But to my mind, and I say this to you, Mr. Fride, I have no doubt that your company--and I speak for myself-- is now proceeding in good faith to find what it considers a reasonable answer to the problem.

However, I do believe that this is the one assumption that your company is making I find may not be universally accepted and a scientific assumption by our people. The difficulty is that we don't have any basis at the present time for making a judgment here. I am not sure you do. I think it is the better part of valor if we see if these scientists can come to an accommodation on that assumption so that we will not be in a position of our scientific people asking us to reject certain of your alternatives out of hand because they don't fit in with that. Now, I really do think that this is the best way to operate.

Thank you, Dr. Mount.

MR. FRIDE: If I can just make one comment about that, Mr. Chairman.

I certainly agree with you and I think that as we always have--you know, this company doesn't have any information that it doesn't put out. It has done it with the State of Minnesota, with the Conservation Department, with every agency, and we certainly would welcome an opportunity to have Dr. Mount, anybody that the State may designate, together with the people who are familiar and conversant with this problem from Reserve sit down and discuss the situation, compare data, examine conclusions, try to reach some kind of a bald analysis. And that is actually what Mr. Haley suggested in his closing remarks.

MR. STEIN: Right.

Are there any other comments or questions?

All right. If not, let me try to summarize this if I can. I think we are proceeding apace, and the difficulty with this is when you are in mid-flight--Yes? Oh, yes. I'm sorry.

Before I start I would like to turn this back to Mr. Badalich, because we don't want to cut anyone off.

Do you have anyone else to make a presentation?

MR. BADALICH: Yes, Mr. Chairman, I was requested yesterday, during the course of the conference, by Professor Charles Huver from the University of Minnesota, that he would like to make a statement at this particular time. So if the conferees so wish, I will call on Dr. Huver.

DR. CHARLES W. HUVER
DEPARTMENT OF ZOOLOGY, UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINNESOTA

MR. STEIN: All right, would you go ahead, Dr. Huver.

DR. HUVER: Mr. Chairman, conferees, friends and neighbors of Lake Superior.

Today I would like to present some of the results of a research project which has been initiated on the shores of Lake Superior. This is going on both on the north shore and on the south shore of the lake in the Wisconsin area. This is a project which has been supported by two organizations concerned about the environment, one the Sierra Club and the other Clear Air Clear Water Unlimited of the Twin Cities

Area.

The title of my statement is "Periphyton Growth as an Indicator of Eutrophication in Lake Superior."

Measurements of periphyton growth are becoming increasingly useful as an index of the aging of waters due to nutrient enrichment, which is often referred to as eutrophication. Excessive periphyton or attached algal growths are generally associated with various forms of nutrient enrichment as well as being a result of the additions of thermal effluents to our waterways.

Nutrient enrichment needed to stimulate abundant algal growths may be either organic or inorganic additions to the aquatic environment. Eyster in a very informative chapter in a book that has recently come out, "Algae, Man and the Environment," from the proceedings of an international symposium at Syracuse University, has summarized much of the data in regard to the nutrient requirements of algae. He has, for example, summarized data that many species of algae respond by substantial growths to media which are lacking entirely in organic constituents and respond to the presence of inorganic materials.

For example, Dr. T. F. Brown of the Kettering Reserach Laboratory has cultured 27 species of algae during the past 15 years under unialgal conditions. All of these species grew well without the addition of organic nutrients to the medium. There is now abundance of evidence from laboratory and field jug experiments that the addition of trace elements can be a growth stimulant to many species of algae. Inorganic requirements for algal photosynthesis include manganese, iron, copper, chlorine, vanadium, and other trace minerals in addition to such major elements as carbon, hydrogen, nitrogen, phosphorus, magnesium and potassium.

At the time of the enforcement conference in May of 1969 I took a trip up the north shore and found there was a highly unusual condition developing, a highly unusual eruption of periphyton or attached algae was observed on the rocks on the beaches between the mouth of the Lester River and Silver Bay. This observation was followed by two separate north shore surveys, one on June 28, 1969, and the other on September 13,

1969. The results are shown on these tables. There is Table I summarizing the results of the June survey and Table II summarizing the results of the September survey.

Would you pass these down. Please take two each.

The results of the June survey were obtained from five north shore stations based upon an average length of periphyton which was determined from measurements of five random samples at each station. High periphyton lengths were measured in samples from Grand Marais Harbor and the station six miles downcurrent from Grand Marais. The average length at these stations was about 7 centimeters in length. This was thought to be due to the nutrients coming in from the sewage discharge at Grand Marais Harbor.

Then as one goes downcurrent toward Duluth and Silver Bay, the level of periphyton reduces considerably to about half of the level at Grand Marais Harbor and the area above Silver Bay, it is still very reduced. But then at the station below Silver Bay we found a marked increase in periphyton growth with levels averaging nearly 12 centimeters.

Dr. C. W. Huver

So this was a rather interesting find and the evidence suggested that there was a major input of nutrients from the Silver Bay area. The amount of the eutrophication index at this station downcurrent from Silver Bay was more than twice as great as that from the Grand Marais Harbor.

So we were interested to see if this relationship would hold up over the summer, so that a more detailed survey was then conducted in September with similar results, only on this survey there were more stations included. There was a total of nine stations and three of these were in the area downcurrent from Silver Bay. The results were essentially the same in September as in the June survey, that there were initially some high levels just downcurrent from Grand Marais, a slight reduction in the levels in the area as we go 25, 30 miles downcurrent from Grand Marais, and then a marked rise in the levels as we go below Silver Bay, a jump in the average length from about 7 centimeters to an average of 13, almost a doubling in the amount of periphyton in terms of the length, which we are using here as an index, so the stimulation of periphyton growth, which in turn is being used as an indicator of the nutrient pollution of the lake. And as we go further down away from Silver Bay we find that there is a reduction in the amount of this periphyton, indicating a lowered nutrient influence at these points.

Now, I selected three slides to illustrate these periphyton eruptions. If we could have the first slide, please.

This is what this periphyton looks like. I am not an algal systematist, but I tentatively identify it as being a species of ulothrix, and this erupted early in May and continued through until September, when there was a marked breakup of the periphyton on the inshore rocks. This reaches its maximum development below Silver Bay while upcurrent from Silver Bay it is approximately half as well developed in the September samplings and also in the June samplings.

So this is a change that has taken place very rapidly in the lake. I only recall in the previous year seeing traces of this on the rocks in the same areas and residents of the area have told me the same thing, that this is a new eruption of this periphyton growth, which is an indication of the aging of the lake and suggests the discharges from Silver Bay are contributing to the lake's aging and that there has been a rapid change in the lake.

Next slide, please.

Fortunately these are localized changes in the lake that are found in the vicinity of pollution discharge regions. On the south shore there are certain areas where there are periphyton eruptions in the bay; Chequamegon Bay near Ashland we find certain areas where you can see these marked eruptions. This is a point for this slide that is 12 miles downcurrent from Silver Bay where we have very luxuriant growth on the rocks that has recently erupted. So that there is evidence of eutrophication in this inshore area downcurrent from Silver Bay.

Next slide, please.

A marked turbidity problem is created in the fall as these algae die and detach from the rocks. This is evident in this photograph taken September 15, last fall, after there had been a marked reduction in the periphyton on the rocks and microscopic analyses of the water show that the water was practically clogged with the dead bodies of this filamentous algae, and as you can see, the clarity of the water is markedly reduced in many inshore regions and this amounts to a considerable turbidity problem. This particular site here was some a little more than 12 miles downcurrent from Silver Bay showing the very material clouding of the water at this location.

So in conclusion, periphyton can be used as an index of eutrophication or aging and the data suggests that the major influence on the north shore comes from effluents originating from Silver Bay. Comparison of the size of the periphyton stimulation in the region downcurrent from Silver Bay with that in the Grand Marias area suggest that there may be a synergistic relationship between the trace metals released in the taconite tailings and the sewage release from the town of Silver Bay.

Thank you. (Applause.)

(The tables referred to by Dr. Huver follow:)

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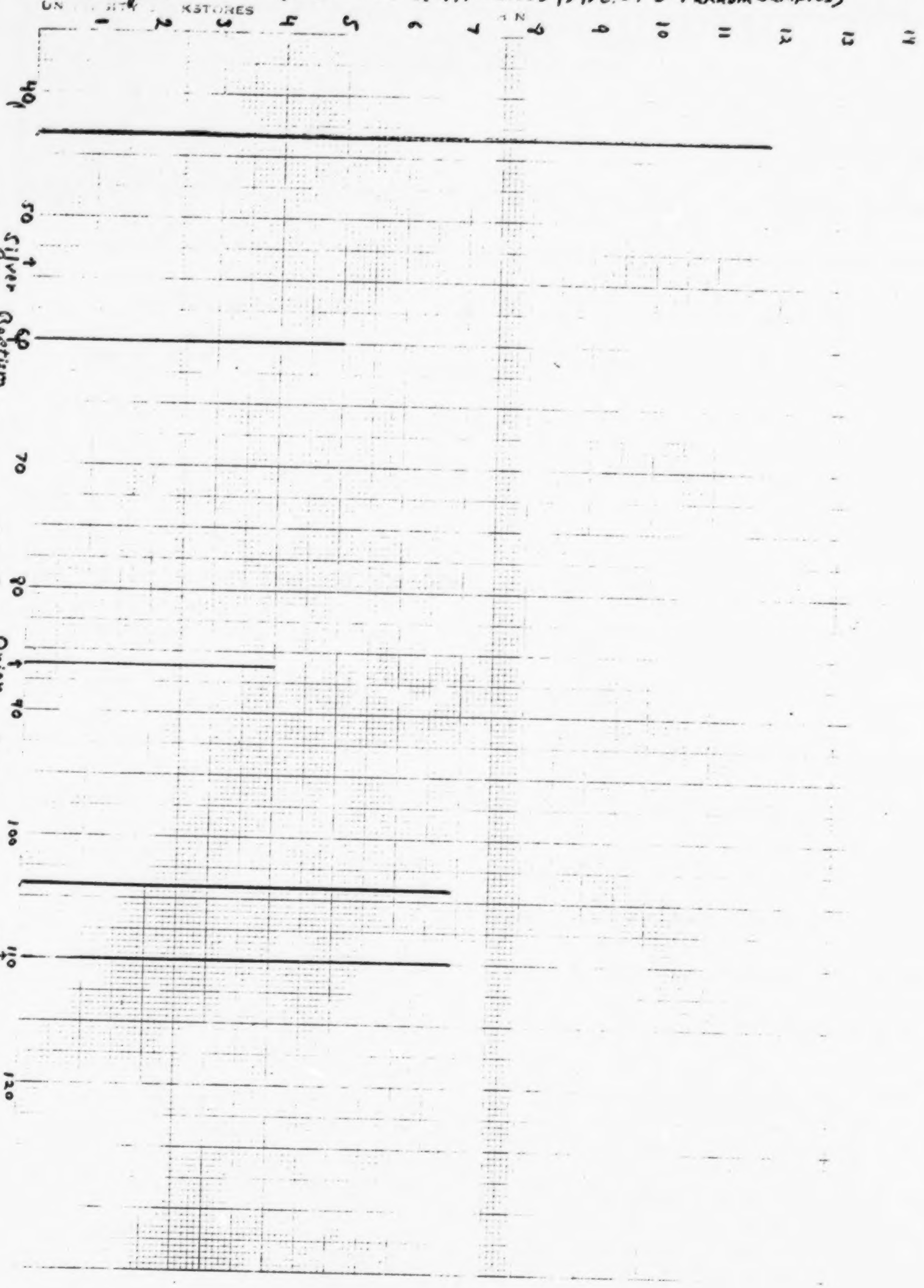
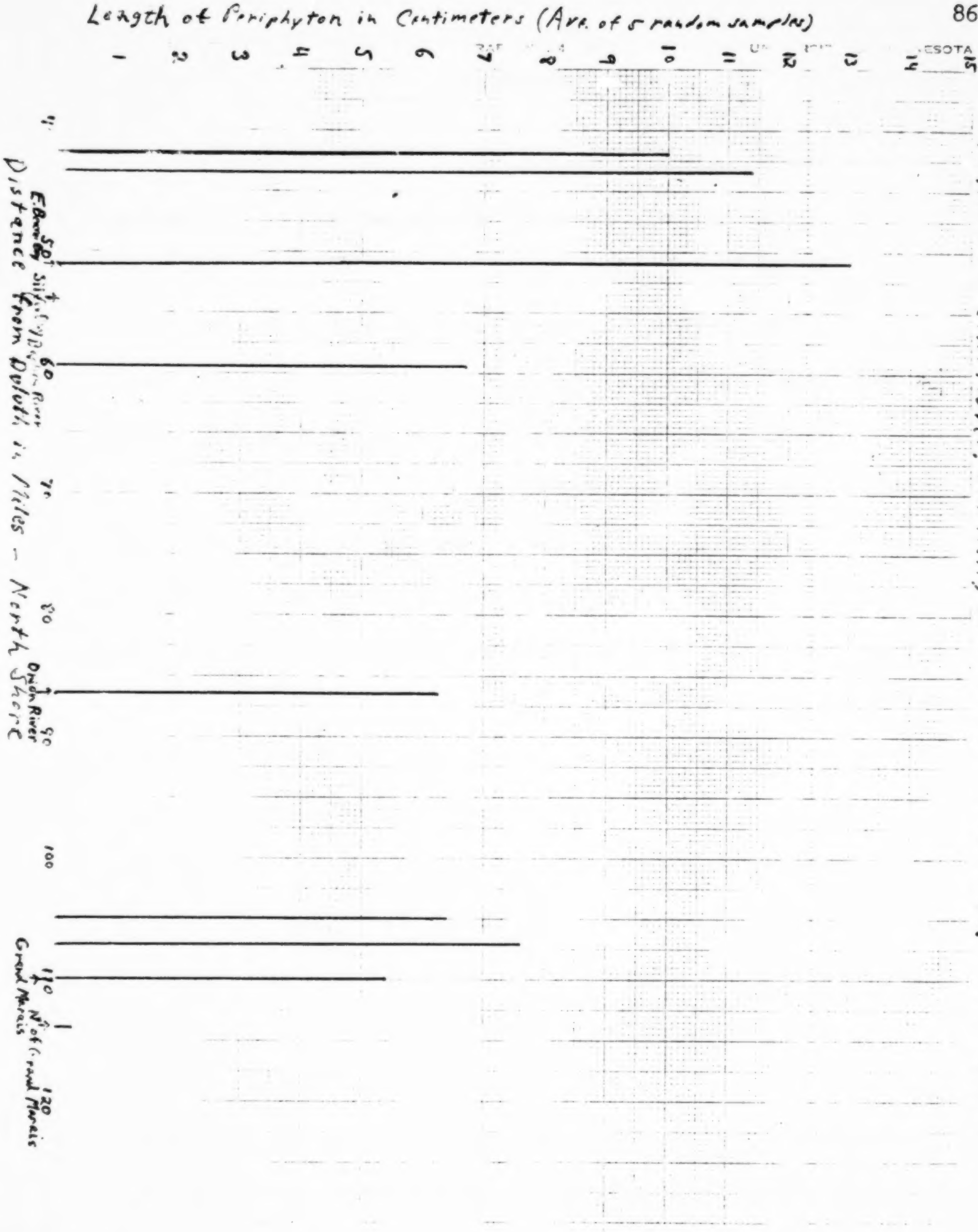
Length of Periphyton in Centimeters (Ave. of 5 random samples)



R. Muller and C.W. Hover University of Minnesota - Table I June 25, 1969



R. Muller and C.W. Huver, University of Minnesota - Table II September 13, 1969

MR. STEIN: Thank you.

Are there any more statements? Mr. Badalich?

MR. BADALICH: No.

MR. STEIN: Does anyone in the audience want to say anything?

If not, let's go on. We have, I think, several items which present themselves.

First I would like to call on Mr. Fetterolf. I hope you people have kept your eye on this. The committee water quality guidelines for Lake Superior have not been accepted here.

By the way, Mr. Purdy had to leave, but he had a little colloquy with me before he left. Mr. Purdy and I have worked together for 15 or 20 years, and we can communicate pretty fast. I think he agrees with what I am going to put forth. We have already discussed this.

I would like to ask Mr. Fetterolf can you indicate for us, by, say, June 15, what water quality recommendations you can have for the States to adopt as criteria for us--the Federal Government--to adopt as standards for Lake Superior and what areas you will have to work with. I would like an indication from you as to what kind of help you would need in terms of staff and money--always keeping in mind that I really do have a limited budget.

MR. FETTEROLF: Gladly.

The committee's proposed water quality guidelines for the open waters of Lake Superior contain 25 parameters. On the basis of a quick review by less than a quorum of the committee, we believe that of the 25 parameters 16 could be recommended for consideration by various State commissions as standards at this time. One parameter was designed as a guideline only and more information is needed on eight parameters. To bring some of these eight parameters into the possible standard category, some additional effort is needed.

As far as money is concerned, Mr. Chairman, you will be pleased to know that Canada is undertaking an in-depth chemical survey of Lake Superior this summer, and we have already made arrangements to have early access to the analyses. It was with great avidity that we granted Canada permission to disregard State and international boundaries during their survey. (Applause.) This permission was probably granted without authority. (Laughter.)

MR. STEIN: That is right. You know, I hesitate to deal with that. I always get called back. You States can do better. Governor Milliken went up to Canada on the mercury, didn't he?

MR. FETTEROLF: Yes.

MR. STEIN: Where I sit, I always have to work through the State Department.

But if you have such good relations with Canada, when are you going to get them to put in secondary treatment? (Laughter.)

MR. FETTEROLF: I don't know very many water agencies that don't have good relationships with Canada. I think they are a very competent group and very well qualified to do the work that they are proposing to do in Lake Superior.

We feel one-half a man year would be adequate for accumulation of already available but not readily accessible data. Money needed to support this essential added effort would amount to approximately $10,000.

MR. STEIN: That sounds fine.

MR. FETTEROLF: Did I hurt you too badly?

MR. STEIN: No, no. (Laughter.) I think we can do this.

Summary

May I make a suggestion? These guidelines and recommendations have not been accepted yet. From Mr. Purdy's reaction today I can understand why. I think what this is going to do is take a little legwork.

I recommend that your committee designate a representative. Be sure that the conferees are familiar with these proposals, really familiar with these proposals, and can act on them in early August. By June 15 the whole report should be in to the conferees.

But I would suggest that before then arrangements be made where representatives of your Technical Committee talk to the conferees and explain this situation to them, because these things are very hard to absorb in detail in a short time. We know if we adopt these they are going to have some far-reaching conclusions and may involve the expenditures of vast sums of money. So before we do that, I think we just have to do our homework. If your committee can take that upon itself, we will consider that at the next session of the conference. I feel reasonably certain, unless we get some extraordinary reverses--and I think the stockmarket has gone up again--we will be able to supply that $10,000.

MR. FETTEROLF: To meet this early deadline, such as June 15, the money must be authorized immediately so a staff person can be hired.

MR. STEIN: Here is the problem. Let me explain this money--and I don't know, maybe you don't want this on the record because this is just detail.

(Off the record.)

MR. STEIN: Let's go back on the record.

We have gotten some pretty good reports from the States. But one area in which I think we will need some conclusions and should have a fairly definitive report is the sources in Minnesota. We had a truly excellent report from Mr. Badalich. But, obviously, one of the crucial sources is at the point of crisis, and the time of decision is going to be within the next few months. I suspect, Mr. Badalich, if we reconvene early in August, you will be able to give us answers to all those sources that you outlined in your report one way or the other--either they are going with you or not.

The next point--and I think this is also a crucial one--is dealing with the Reserve Mining Company. I think, again, we have to recognize that the 6-months' date runs out July 26, and getting the views of the conferees--I am repeating what I think is a consensus here--that the conference expects that 1) the Reserve Mining Company will have selected a plan or a combination of plans or a series of alternates which are ready for detailed engineering and acceptance which it, Reserve Mining, believes will meet its obligations to preserve the qualities of the water of Lake Superior, prevent water pollution and satisfy the regulatory agencies; 2) that these plans will be submitted to the conferees by July 26 at the latest; 3) that the conferees will consider this at their session in early August, at which time the conferees will make a judgment as to which one of these plans, if any, will be acceptable; 4) and we will recommend at that time, if any are acceptable, that Minnesota handle this under its State and local law, as we are required to do by law; 5) and if we find that none of them is acceptable the conferees will have to make a judgment on where we move from there.

I think the time has come for decision. I will say this: The company has approached this with vigor. I think the conferees are approaching this problem with vigor. When we went to the original session of the conference, we thought we might have an answer in 6 months. I think when we shake the dust in the box, we may come up to the crucial point in 10 months. I think during that 10 months all the State and Federal regulatory agencies have exercised a considerable measure of forebearance. But I think come early August we are going to make a decision one way or the other, and I hope the company will be with us on the decision.

I would recommend that the company get together with the State office, Mr. Badalich, Dr. Mount, Mr. Mayo, and all these people, so you can be reasonably assured that the assumptions you are proceeding on in developing these plans are going to be acceptable and satisfactory. I think it might save a lot of anguish and money and time all around if we do this.

Is this acceptable? I know it is acceptable to Mr. Purdy.

Is this acceptable to you, sir?

MR. BADALICH: Yes, Mr. Chairman.

MR. STEIN: Are there any other points we want to put into the summary?

If not, I want to thank you all for sticking with us. I know, as you can see, once you get to a certain point, pollution control gets down to a highly technical operation of dealing with a problem source by source. It never moves evenly. But in this case, and I say this for all the participants here--the citizens, the alleged dischargers and the conferees--I think all have approached this really in good faith. I think we are making progress. I say this advisedly because I see us moving forward. I am hopeful, with good will, maybe a little larger dose of good luck, and hard work we are going to come to an amicable solution to this situation.

With that, thank you again and we stand adjourned.

(Whereupon, at 5 o'clock,the conference adjourned.)

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